LEARN PAD

Deliverable D1.1

Requirements Report

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Abstract

This document identifies Learn PAd as a socio-technical ecosystem that is based on fundamentals of process-oriented learning and consists of a set of software components, the so-called Learn PAd platform. It is based on a conceptual framework represented in form of conceptual and semantic models as well as on usage scenarios specifying the introduction and usage of Learn PAd within PA. Those viewpoints are introduced as the PARADIGM, TECHNOLOGY, (MODELLING) LANGUAGE and USAGE. Those viewpoints are elaborated in the deliverable to underline the process-oriented approach of goal-based learning that is performed in the everyday working environment of Civil Servants. Four high level functional building blocks are identified as:

(a) "Knowledge, Learning and Business Process Context", which describes the legacy eco-system

(b) "Collaborative Business Process and Knowledge Based Learning", which is the so-called core platform that enables knowledge sharing, learning and simulating

(c) "Business Process and Knowledge Based Learning Modelling", which provides modelling features to create the content, allocate profiles and define goals, as well as

(d) "Business Process Learning and Knowledge Assessment", which provides learning assessments, analytics and graphical representation resulting goal achievement.

Based on an adaptation of the Volere template, more than 300 requirements have been openly collected using Wiki pages, which haven then been analysed, grouped, ranked and consolidated by a core group in individual readings, cross-readings and panel discussions. The results are 191 requirements that extend the aforementioned four viewpoints by introducing characteristic and required functional capabilities. Those selected requirements are presented in this document as a major part. A goal model analysis constructed a hierarchical order to identify incompleteness, which had been corrected. The outlook indicates how this description of the overall Learn PAd approach is further used in the project.

Keyword List

Requirement Analysis, Learn PAd System, Learn PAd Functional Capabilities

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Glossary, acronyms & abbreviations

Item	Description
CMMN	Case-Management Model and Notation
DOW	Description of Work
EC	European Commission
ECAAD	The Evidence Centered Activity and Assessment Design
KAOS	Knowledge Acquisition in Automated Specification
KPI	Key Performance Indicator
PA	Public Administration
PDCA	Plan-Do-Check-Act
RE	Requirements Engineering
WP	Work Package
WPL	Work Package Leader
XWiki	XWiki is a Wiki environment

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1 Introduction

1.1. Purpose of this deliverable

This deliverable reports on the collection and analysis of requirements for the Learn PAd system, briefly introduces the four major dimensions (a) Learning Paradigm, (b) Modelling Language, (c) Technology and (d) User Scenarios and finally works out the goal-models based on the requirement analysis to provide consolidated input for future development steps. In order to openly approach this complex domain of technology enhanced learning in the public administration a collaborative bottom-up collection process had been performed using the well known Volere [15] based templates in XWiki. This approach had been triggered to collect heterogeneous requirements for four months. In total there were about 320 requirements collected that had been grouped and categorized in a second phase. In parallel the four dimensions had been detailed were necessary. In the following the four dimensions are quickly introduced:

1) The Learning Paradigm states the high level concepts of the Learn PAd thought patterns and hence describes the mental mind setting in which Learn PAd is expected to run.

2) Although the term "modelling language" is commonly used, the correct term is "modelling method" that includes the "modelling language" as one major part beside processing and procedural aspects.

3) A correct introduction of the model-based approach enables a concrete alignment of requirements.

4) The Technology introduces a first and high level view of functional capabilities of the Learn PAd system. Although the details on the architecture is currently in progress, the high level grouping of functional capacities already provide a first insight into high level technical building blocks of the architecture.

5) The User Scenarios are use cases, features or scenarios that have been collected to underline certain required features of Learn PAd.

To provide a high-level hierarchical view of the main needs of the system and enable further analyses, goal models [27] have been also provided according to the elicited requirements.

1.2. Structure of this deliverable

After the introduction of the four dimensions, the requirement collection and analysis process is briefly introduced. At this early stage of the project it was considered important to openly collect all emerging requirements rather than to only restrict the list to those that will eventually be implemented within Learn PAd. After the open collection, several phases of consolidations, groupings and refinements have been performed in different ways, till a consolidated list could be released. It has to be stated that those requirements are on a level of detail to clearly represent the expected behaviour and highlight certain aspects of the platform.

In order to prepare the upcoming evaluation phase of the requirements, a goal model has been developed out of the requirements list. Not only such goal model supports requirement analysis by allowing us to put requirements in a hierarchical dependency structure and complete missing aspects, but also it can be used as an evaluation model. In order to evaluate the fulfilment of the requirements the goal models are interpreted as a "cause and effect model" of a scorecard. Hence each requirement is interpreted as a criterion, which needs to be fulfilled in order to achieve the high level goal.

In the following the structure of the deliverable is introduced, where Chapter 2 presents the methods for requirements collection and analysis that have been applied in Learn PAd. Chapter 3 describes the viewpoints under which the Learn PAd system had been observed. Chapter 4 provides the consolidated a list of identified requirements. Chapter 5 introduces the goal models that are used to the present and evaluate the dependencies of the requirements. Finally, Chapter 6 draws the conclusions of the report.

2 Applied Methods for Requirements Collection and Analysis

The Learn PAd consortium mixes different expertise in the area of software engineering and modeling, business process modeling and analysis, knowledge and learning management, and public admnistrations. The socio-technical system to be studied, and the learning platform that will be the result of the project, ask for the integration and exchange of ideas and understanding among the various partners. In order to foster cooperation and to make easier the sharing of ideas, within the consortium several "collaborative" sessions were organized during the various project meetings. The final objective of these sessions was to give the opportunity to partner members to state their needs and to listen to the needs of the others. Clearly these activities successively led to a first version of the requirements list.

2.1. Requirements collection and classification

The process-oriented knowledge management framework PROMOTE®has been used as a guideline to initially assess use case processes and identify key challenges when applying process-oriented learning in public administration.

The reason of using PROMOTE®is to put the business process of the public administration in the center and to analyse knowledge as it would be a product. Hence knowledge is introduced as a consumable good that can be accessed either in form of a product or in form of a service.

Each knowledge product is produced following a knowledge management process, hence activities that result in a knowledge product - like the generation of a questionnaire - are considered. Furthermore, each of those activities in a knowledge management process requires certain competences, hence roles, expert levels and responsibilities are considered.

The IT-infrastructure that supports the knowledge management processes, and corresponding knowledge roles and workers, is identified in form of the so-called "knowledge resources". In Learn PAd those knowledge resources are reflected in the functional building blocks. Finally PROMOTE®discusses the content and the ways to structure, categorize or ontologically describe knowledge. All aforementioned dimensions have been applied to initially identify key bundles of functional capabilities and requirements.

As the technological Learn PAd platform is a focus of Learn PAd research activities, the Kruchten's 4+1 view model [12] had been considered while discussing and collecting requirements, in order to create high level requirements that can be further used. Mainly the discussion on functional capabilities that draft a first architecture on building block level were used.

For actual structuring of the requirements the widely used Volere template [15] has been adapted, and has been applied by building a specific application within the XWiki collaborative platform installed for internal use[1]. In such a way the consortium managed to collaboratively work on collecting a first version of the list of requirements.

The process of requirements engineering (RE), where the technologies outlined above have been practically employed, was separated in the following two phases.

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[1] http://wiki.learnpad.eu

First Phase

The **first phase** of the Learn PAd RE process was divided in three sequential steps. The *first step* was the initial collaborative sessions (workshops) with the consortium partners in order to define a broad set of applicable requirements according to the identified goals of the project. During the collaborative sessions the participants were split in different groups who had to focus on the different dimensions and aspects of the Learn PAd socio-technical system (such as modelling, technical, end user, etc.). The division in groups was done in order to avoid crowded groups (each group had at most 8 participants including the moderator), in which shy people generally do not share much their ideas, and to have people with different expertise in the same group. The work of each group was moderated by a member of the CNR partner who, before the meetings, planned the activities to be done by the group. In particular the work of each group was organized using a mix of the KJ method [10] and brainstorming. The KJ foresees that after an introduction to the problem and objectives that the group has to reach, in this case the clarification of the specific dimension/aspect for the Learn PAd system, each member of the group starts to reflect by himself/herself and fills a simple card in which a specific need is reported. After this first step the moderator collected all the cards filled by the members. Successively thanks to an open discussion with all the grop members the cards were grouped according to their functional homogeneity/proximity.

In order to foster cross fertilization among the various partners the members of the various groups changed at every meetings. Clearly the result of the groups were not ready-to-use requirements but a set of needs and statements that could easily stimulate the discussion and the cooperation to finally derive some sort of requirements from each card. Therefore, in the *second step*, the consortium agreed on an open and collaborative method to collect and analyse requirements. Once all requirements were reported on the internal collaborative platform (`http://wiki.learnpad.eu`) and the various partner members were asked to read, revise and augment the "statement" list to finally derive requirements. The requirements were stored according to an adapted Volere [15] template to ensure traceability and enable further refinement and analysis. Clearly the activities described so far were prodromic to a more structured work on the requirement definition and their organization/analysis. On the other hand it is worth mentioning that fostering open discussions and integration of members lead to a quite relevant number of initial requirements and to a better and shared understanding of the project objectives by the partners. This was followed by an activity where the actual requirement owner (i.e., the one initially proposing the requirement) was requested to refine the specification and adjust it to the project's requirements template. Additionally a brief analysis was carried out to identify overlaps and double entries.

The *final step* of the first phase initiated the structuring of the requirements by defining a set of tags that have been used to categorize the requirements. This was done on applicability level by applying tags such as modelling language, access control, etc., as well as on the organization level by tagging applicable requirements with a specific work package tag. The first phase resulted in a list of about **320 requirements**.

Second Phase

The **second phase** of the process was dedicated to the analysis of the available requirements. First all requirements have been cleaned. For that purpose an export had been generated form the XWiki platform to a spreadsheet format in order to allow filtering, comparing and alignment. Titles to group the requirements have been indicatively provided, dimensions and structure had been worked out and used to categorize the requirements and an indicatives scoring had been applied: (a) ACCEPT; (b) PROVISIONALLY ACCEPT, (c) DETAIL REQUESTED or (d) REJECTED.

The requirement analysis had been performed by a core team of key partners that detailed the requirements were necessary, worked on the title and grouping as well as re-considered the original scoring. In a panel meeting of the core team each requirement was discussed and concluded with a complete list of requirements reflecting aforementioned Learn PAd dimensions and providing reason-

able insight into the aimed Learn PAd system for further WPs.

The set of consolidated and approved requirements consists of **191 unique elements**, which are introduced in Chapter 4, plus the scenarios reported in Section 3.5.

To make easier the access to the content, the requirements are listed in several tables that are grouped according to the four dimensions, where only the major attributes relavant for the readers are displayed, leaving out some field used for the purpose of analysis and prioritization, internal comments, and grouping information, that nevertheless can be accessed on the corresponding internal Wiki pages.

2.2. Goal oriented requirements analysis

After the requirements analysis activities described in Section 2.1, goal oriented requirements analysis has been performed on the elicited and categorised requirements.

The objective of this activity was to identify a set of higher-level goals, which can provide an abstract view of the needs for the project. Such an abstract view can be used to identify missing aspects, and enable structured reasoning on the requirements at the problem-space level before the solution-space (e.g., architectural solutions, design solutions, technical solutions) is explored.

It is worth noting that this abstract view does not substitute the requirements analysis that brought to the set of consolidated requirements. Instead, it provides an abstraction means to analyse and enrich the requirements, spotting out missing requirements and giving guidance to further elaborate on the project's needs. To provide such an abstract and hierarchical perspective, we have decided to employ the Goal modelling methodology [27].

In particular, we have used the KAOS goal modelling technology [27, 28], which allows deriving high-level goal models in the form of hierarchical tree structures. Seven goal models at different levels of detail have been derived from the requirements by considering and grouping the justifications associated to the requirements (a justification provides a rationale, and therefore a high-level goal for a requirement). The derived models have been informally analysed and used to identify missing and underspecified needs from the current set of requirements. Such needs have been listed, and comments to further elaborate on such needs have been provided. In particular, we have found that under-specified needs at this stage include six main topics: (1) Procedure monitoring (i.e., monitoring of the activities of the civil servants in their application of the procedures); (2) Quality of simulation scenarios (i.e., degree of quality of the learning content used for simulation); (3) Simulation-based evaluation (i.e., evaluation of learners according to the tests performed by means of scenarios); (4) Role of ontologies (i.e., the usage of ontologies in the platform); (5) Organization of training sessions (i.e., the planning, structuring and schedule of the training sessions); (6) Profiling (i.e., the usage of different learning and access profiles).

This list of topics has to be considered as a set of "warnings", to be taken into account in the subsequent development phases. We agreed that, at this stage, detailed requirements cannot be provided for these topics, either because they are cross-concerns that can be better addressed when an architecture is defined (i.e., 3, 4, 6) or because they involve practical organization and planning activities not only related to the platform but to the whole human/system environment (i.e., 1, 2, 5). Such topics will be considered at later development stages, and specific actions will be taken to address the need for more detailed requirements concerning the under-specified topics.

3 Learn PAd Requirements Dimensions

In order to collect and analyse the requirements for the Learn PAd socio-technical system, it had been considered as the so-called "object under study". Hence it had been observed by different viewpoints to collect heterogeneous and independent requirements.

Here we see the Learn PAd system not only as a collection of technical components but as a socio-technical ecosystem with the aim to support learning in a process-oriented public administration environment. In the following a short discussion on the Learn PAd system is given and the four dimensions, under which the Learn PAd system had been observed, are introduced.

3.1. Dimensions overview

Learning and Knowledge Management systems are typical socio-technical systems, as the learning process and the knowledge evolution happen mainly in the head of humans. The well-known tacit knowledge, cognitive self-reflection and the creation of new knowledge in form of newly created cognitive patterns have to be supported by software technology and so-called explicit knowledge that is available in a time, location and context independent way.

The challenge to align software component, content with the learning of human brains should motivate the socio-technical aspects, as the aim of this project is the software implementation of a learning platform in the public administration.

Hence, although each of aforementioned statements can be detailed and critically discussed in the domains of learning, cognition, knowledge management, artificial intelligence as well as in concept and semantic modelling, we see the need of their consideration at the level of user interaction with the Learn PAd system

Hence, under this thinking paradigm we distinguish:

- The **Learn PAd system** describes the socio-technical eco-system and hence includes the technical components, the content, the organizational context and processes as well as the conceptual thinking paradigm. Observations and requirements are grouped as **PARADIGM**.

- The **Learn PAd platform** describes all technical aspects starting with the core building blocks of the Learn PAd platform, and also includes the interaction with legacy systems. Observations and requirements are grouped as **TECHNOLOGY**.

- The **Learn PAd concept** describes the bridge between the Learn PAd system and the Learn PAd platform, by introducing conceptual and semantic modelling that can be represented by and to the human users in an appropriate - mainly graphical - way, but have the capability to be processed by technology. Hence, those conceptual thoughts reflect aforementioned interface from learning and knowledge dimensions towards technical components. Observations and requirements are grouped as **LANGUAGE**.

- The **Learn PAd usage** describes how the Learn PAd system can be introduced and applied into an organization and considers cultural, organizational, change management and legal aspects when introducing such a system. Observations and requirements are grouped as **USER SCENARIOS**.

Hence the setting where Learn PAd system will be used can be considered as a relatively complex environment. This stems from the fact that it should support technology enhanced learning - focusing on a process oriented view - within an environment that is affected by a set of exogenous factors like law amendments having effect in the public administration domain, or changes toward the research funding in the EPBR use case. In the following subsections each of the introduced dimensions are elaborated in more detail.

3.2. The Learn PAd System - PARADIGM

This section will introduce the Learning Paradigms that have been taken into account when electing the Learn PAd requirements. Based on previous experiences in the domain of public administration, knowledge management and (technology-enhanced) learning, Learn PAd identifies the following general constraints in that context:

- All knowledge required by civil servants- and hence all learning- is used in and applies to the execution of business processes. The knowledge must be available quickly within the context of a process execution. Learning by practically applying the business process is suitable for such an on-demand learning situation that is embedded within the working environment.

- Learners are guided in a goal oriented way, to (a) ensure compliance with legal regulations, (b) support organizational goals, and (c) provide appropriate learning experiences depending on the learners' capacities.

- Business processes to be executed by civil servants are often complex and knowledge-intensive. Decisions have to be made that depend on many factors; many possible exceptions can occur. It is usually very hard and hence inappropriate to compile a comprehensive syllabus of the required knowledge. A case based learning is therefore the selected approach in Learn PAd.

3.2.1. Process-oriented knowledge management

The first of the above constraints implies that knowledge must be made available in the context of process executions, in order to support what is called "on-line learning". Ideally, a learning system is aware of the exact situation in which civil servants are working and is able to recommend all the required knowledge to them. Of course, such awareness of the system requires a concise description of contexts and an alignment of artefacts like codified knowledge, with these contexts, e.g. through adequate meta data or direct linkage between process activities and the relevant artefacts. An important approach that supports such context-awareness is the method of "process-oriented knowledge management" [5][1] that proposes a close analysis and modelling of knowledge generation and consumption within business processes. The Learn PAd approach incorporates this method by its very design- the ultimate goal of all modelling endeavours being the alignment and integration of information and learning material with the activities of business processes.

3.2.2. Goal-Oriented learning approaches

The second of the above constraints implies that learning goals are to some extent derived from external circumstances. Furthermore, for any organization, including public administrations, it is desirable to plan the competence development of their employees and align that development with the organizational strategy. These considerations lead to the conclusion that mechanisms are needed that support the derivation of learning goals from an organization's strategy and external constraints in a top-down way. In addition- in order for such approaches to be feasible- it must be possible to accurately measure the achievement of the formulated (learning) goals. Finally, it must be possible to plan not only the

competence development of individual employees (by breaking down from organizational goals), but also to explicitly formulate goals for organizational learning.

There are various approaches that support these needs:

- The general principle of deriving strategic goals from a company's strategy is introduced in the Balanced Scorecard approach [22]. The original Balanced Scorecard has been developed to assess the financial success of an enterprise with four dimensions. As this approach is flexible, it has been refined to introduce knowledge-relevant dimensions. It has been adapted and refined to knowledge management and learning goals, resulting in a so-called Knowledge Maturing Scorecard [8] that provides general guidance for deriving learning and knowledge maturing goals and for measuring the achievement of such goals. A Knowledge Scorecard consists of the dimensions: (a) knowledge, (b) processes, (c) human capital and skills as well as (d) resources consisting of infrastructure, budget, material & machines and information.

- The e-learning measurement framework proposed in [26] can be used as an additional guidance to derive metrics and indicators for learning success. The framework lists six measurement levels from which concrete metrics can be derived. These levels are given by 1) learners' participation, 2) reaction (e.g. percentage of learners completing the evaluation process), 3) measurable outcomes such as percentage of learners passing an examination, 4) job application of the acquired knowledge, 5) business results (e.g. impact on time-to-market), 6) Return on Investment.

- Existing top-down competence management approaches (e.g. [14]) provide principles of deriving competence development plans from an organization's strategic goals: by analyzing the knowledge needed to reach the goals and by identifying the gap- i.e. the knowledge or organizational capacity that is still missing- competence development measures can be developed globally and broken down into learning goals for individual employees.

We apply the general principles described in these approaches to the Learn PAd environment and use them to derive requirements that refer to goal derivation from strategy, measurement of goal achievement and maintenance and planning of competence profiles.

3.2.3. Bottom-up learning approaches

Finally, the third of the above constraints means that a pure top-down approach to guiding learning processes is not feasible. In the past, one frequent reason for the failure of top-down approaches has been the missing integration of skill development measures with the work -context of employees- i.e. companies made attempts of transmitting knowledge in off-line scenarios that could not be readily transferred into on-line work situations (see process-oriented knowledge management above). Another obstacle is the complexity of many business processes that involve many infrequently occurring exceptional situations (the "long tail"). For such situations, top-down modelling and structured codification are inefficient and often impossible since they cannot be anticipated.

Attempts to lower the burden of knowledge codification are often based on the insight that the whole community needs to be involved and needs to be motivated to share their knowledge in a Web 2.0 style, leading to approaches termed "collaborative learning" [2] [18] or "E-Learning 2.0" [4]. Another insight is that knowledge and its codification usually need to evolve along several phases, as described by *the knowledge maturing model* [24] - where knowledge maturing is defined as goal-oriented learning on a collective level.

In addition, it has been recognized that not all persons have the same attitude towards knowledge sharing [16], i.e. different motivational strategies need to be combined. It has also been found that careful guidance for knowledge sharing is an important success factor for "Enterprise 2.0" endeavors [20]. Hence, the Learn PAd system needs to be carefully designed in order to support knowledge sharing and motivate civil servants to contribute their knowledge. Requirements will be derived accordingly.
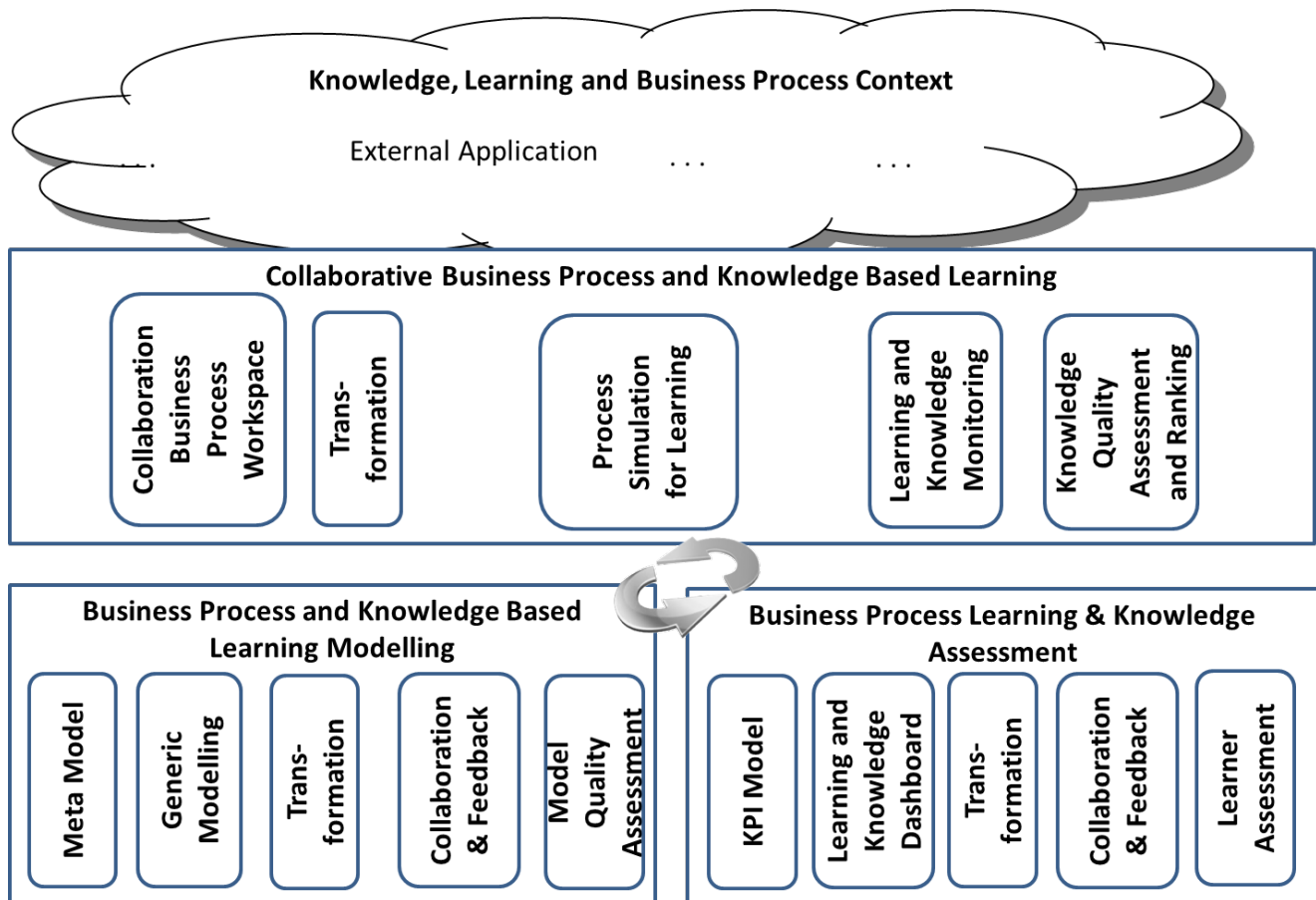
Figure 3.1: High Level Building Blocks for Learn PAd Architecture

Finally, since the effort of codification is really too high for rare exceptional cases, the "knowledge personalization" strategy is an alternative to knowledge codification [4]. In order to support such personalization strategies, a learning system must be capable of recommending the right experts when certain knowledge is needed. Recommendations can be based on manually crafted skill catalogs or - again - on community contributions as in [3].

Those three aspects (a) business process as the central knowledge platform, (b) goal-oriented learning by knowledge workers as well as (c) case based learning in a bottom-up manner are considered as the Learn PAd paradigm that needs to be mapped with concrete technical solutions that are discussed in the next section.

3.3. The Learn PAd Platform - TECHNOLOGY

In this section we present a high level technical overview of Learn PAd platform in form of functional capabilities that are further transformed into an architecture in WP2. For the initial separation of concerns the high level reference architecture building blocks for knowledge and learning systems developed in MATURE [17] and published in [29], [30], are considered as a starting point.

The first iteration to define buildings blocks of functional capabilities started from aforementioned reference architecture and transformed it into the Learn PAd context via physical workshops, telephone conferences and while collaboratively working on this chapter. The result is presented as Figure 3.1 indicating the major building blocks from the reference architecture and grouping functional capabilities in the context of Learn PAd. The high level architecture will be developed based on that grouping of functional capabilities.

Figure 3.1 introduces the four high level building blocks starting with (1) Knowledge, Learning and Business Process Context that considers the complex and heterogeneous operative legacy systems of the end users, (2) Collaborative Business Process and Knowledge Based Learning that enables a process-oriented learning from knowledge workers, (3) Business Process and Knowledge Based Learning Modelling enables the definition of learning processes that are then realized in the aforementioned execution environment and finally (4) Business Process Learning and Knowledge Assessment introduces monitoring and dashboard functionality to identify improvements opportunities.

In the following sections, the four building blocks, and the initially identified main components, are described.

3.3.1. Knowledge, Learning and Business Process

This building block is seen as the collection of all relevant legacy application that are necessary to execute the business process. As neither the Learn PAd project nor any advisor or consultant that uses Learn PAd results after the project will likely have an influence on such heterogeneous landscape of legacy applications, Learn PAd proposes three ways of integration.

- First integration is a loose link, from the Learn PAd to the legacy applications. This is most likely the first choice, ideally if the legacy application is a Web-application. Hence, this will be a Hyperlink to the Web-interface of the legacy application

- Second integration is via an implemented API. This will be used, if valuable learning or feedback information is required from the concrete legacy application. In case a social enterprise tool, enterprise wikis or the like are already in place, it may be worth to implement an interface. (e.g KPI container)

- Third integration are Learn PAd components that are additionally used in the system environment, hence the integration is given by the use of Learn PAd components.

3.3.2. Collaborative Business Process and Knowledge Based Learning

This building block is seen as the collaborative user interface towards the Learn PAd platform. Business Processes can be trained by the end-user in a manual or automatic way and can provide feedback and / or collaborate with others. This environment is seen as a hybrid solution from static business process documentations, interactive process-steppers and workflow engines as well as collaborative Wiki pages. The challenge is to find the appropriate feature mix that is flexible, collaborative and business process oriented but in the same time user friendly, functionally focused and intuitively usable.

- Collaborative Business Process Workspace groups all functional capabilities for a user friendly entry point. There may be the need to present business processes also graphically, but more importantly the business processes phases, the corresponding documents, the required skill level and the capability to provide feedback and comments in form of an intuitively Wiki are provided in form of a collaborative environment. Typical sample for a feedback are improvements suggestions to better describe a business process or even comment on the business process itself.

- Process Simulation for Learning is used by the knowledge worker in order to learn how the process has to be executed. Depending on different skill levels the process is simulated in a form that the knowledge worker performs each step with the correlated content. Hence the process is not executed directly but simulated with the aim to derive findings out of recorded clicks and links. Focus is the end users interaction with the platform and with the process so the user learns to perform the process in practice.

- Transformation establishes the link with the other major building blocks, in technical terms it will consist of gateways, transformers or similar components, in conceptual terms it will consider semantic distances and context transformation and in usage terms it will consider adaptability and maintenance issues.

- Learning and Knowledge Monitoring is able to collect data from the usage of the platform like contributions or actions during simulations.

- Knowledge Quality Assessment and Ranking is considered to enrich the previously collected data with learning specific context to enable a ranking or enabling query in order to report anomalies or provide quality checks of models and content.

3.3.3. Business Process and Knowledge Based Learning Modelling

This building block is used by trainers to design business process models for the public administration. Typical conceptual and semantic modelling will be applied to define relevant conceptual artefacts that are processed for management and improvement as well as exported into the aforementioned building block – Collaborative Business Process and Knowledge Based Learning. This design environment is expected to be implemented with different modelling and management software, whereas the difference between a simple modelling and a management tool is the capability of "model processing" of the latter.

- Meta Model is a domain specific modelling languages specification that is commonly used in high end modelling platforms. The meta model in Learn PAd basically consists of three parts (a) the domain specific part, (b) the part for economic modelling like navigation and hyperlinks as well as (c) technical relevant parts that are necessary e.g. for repositories or graphical representations. The big challenge is therefore to translate a conceptual meta model into a technical meta model that can be grounded on a particular software platform.

- Generic Modelling covers typical modelling and management capabilities around the four functionality (1) Graphical visualization of models, (2) Query and analysis features of models, (3) simulations of graphs as well as (4) transformation into different input and output formats. Depending on the platform and usage scenario the aforementioned generic modelling features are differently grouped or detailed.

- Transformation establishes the link with the other major building blocks, in technical terms it will consists of gateways, transformers or similar components, in conceptual terms it will consider semantic distances and context transformation and in usage terms it will consider adapt abilities and maintenance issues.

- Collaboration and Feedback transforms the previously made "Wiki-like" collaboration functionality into the modelling tool. Hence features like track changes, ratings or comments are considered in this group. This is a learning specific component and hence one of the core add-ons for modelling tools to inject them with Learn PAd philosophy.

- Model Quality Assessment is considered to enrich the models with learning specific context to enable a ranking or enabling query in order to report anomalies or provide quality checks of models.

3.3.4. Business Process Learning & Knowledge Assessment

This building block is used by experts and trainers to analyse the use of the business processes and assess, which part of the process is well supported and trained and which need adjustments. A dashboard displays key performance indicators that enable the assessment of the maturity, skills and training levels of the process and its end users.

- KPI Models define the overall learning and process monitoring environment. Hence such KPI models build a knowledge maturity scorecard and consist of conceptual definitions, reference content, representation-standards and of technical realization capabilities.

- Learning and Knowledge Dashboard is seen as a cockpit for the trainer that represents KPIs for learning and knowledge maturity in a Scorecard like presentation. The display, search and presentation of learning goals and corresponding indicators are collected in this functional capability.

- Collaboration and Feedback transforms the previously made "Wiki-like" collaboration functionality into collaboration and feedback features into the dashboard.

- Transformation establishes the link with the other major building blocks, in technical terms it will consists of gateways, transformers or similar components, in conceptual terms it will consider semantic distances and context transformation and in usage terms it will consider adaptability and maintenance issues.

The aforementioned grouping of high level functional building blocks had been used as a starting point in order to collect technical requirements. In parallel to the collection phase, there was also an evolution of the architecture, hence the functional building blocks have already evolved and will further evolve in the detailed architecture discussion.

For the purpose of this document, they have been found useful to group and hence separate concerns for the collected requirement.

3.4. The Learn PAd Concept - LANGUAGE

Conceptual and semantic models raised commodity in current IT supported management approaches, as they have been proven to enable the human and machine readable representation of knowledge. Typical samples are business process model that make the normative knowledge within an organization on how certain tasks are performed explicit in form of a graphical representation. As those graphical representation do not only depend on a notational element but can be mapped to semantic, those business process models become then automatically manageable by software systems, hence functions like queries, simulations or transformation on those business process models can be performed by software programs.

Raising the semantic enrichment of the models, the applied functionality become smarter, but the corresponding semantic models become more formal and hence more complex for the user. Hence the conceptual challenge is to provide sufficient detailed formalism in order to perform appropriate functionality and on the same time keep the complexity for the user to the appropriate level, so that users can work with those models even they do not have a sophisticated education in mathematics or semantics.

Based on the research from the Open Models group [9], there is a framework that describes the major building blocks of modelling approaches. It has been first published in [13] and [11] as the Generic Modelling Method Specification Framework, that considers all necessary aspects of a modelling method.

3.4.1. Modelling language

The Modelling Language is most prominent aspect of the overall modelling method. It defines the semantic primitives that are available in order to create the intended model. Typically the modelling language consists of syntax, semantic and graphical notation.

- Syntax defines the objects like classes, attributes or relations that are used to design graphical models. Syntax on the class level defines the attributes of the classes. Depending on the construction of the modelling language the syntax differ from formal to informal objects, abstract vs.
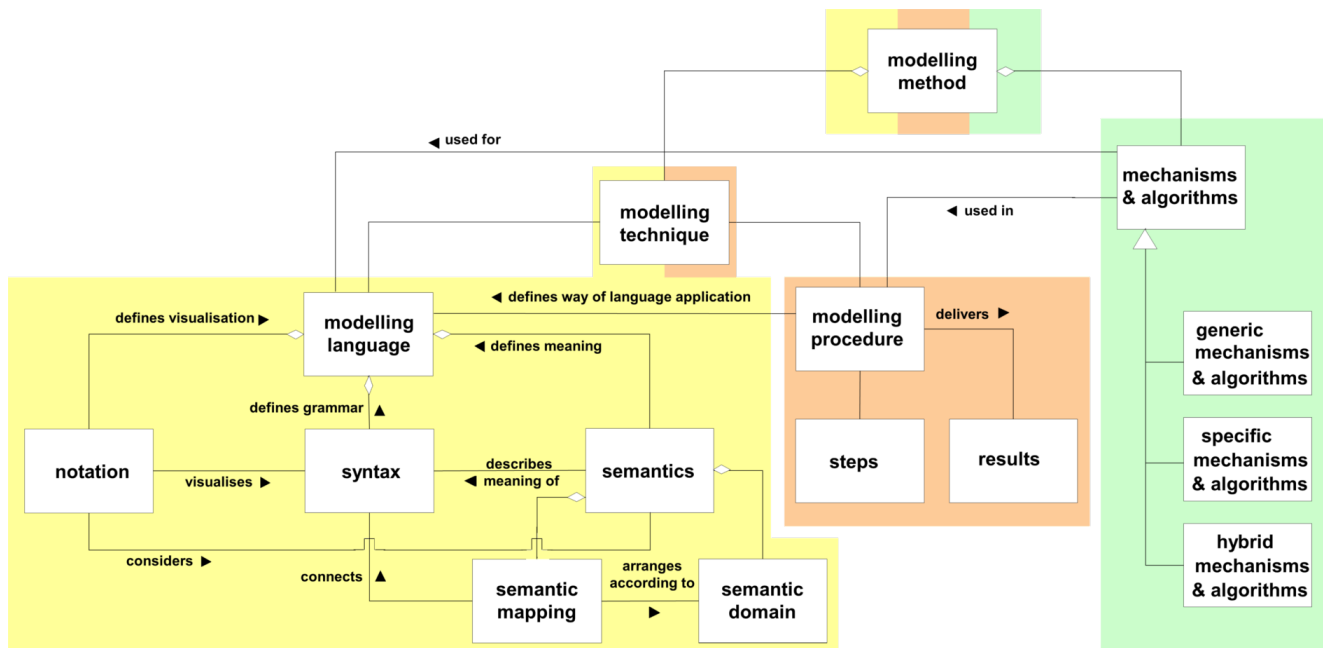
Figure 3.2: Generic Modelling Method Specification Framework

concrete classes, or define a range of attribute types. Additional concepts like templates, patterns or model types also belong to the syntax.

- Semantics provides the meaning of each object of the modelling language. There are different ways to inject a modelling with semantic, most prominently is the operative semantic that maps objects to well-known mathematical theories - most prominently the directed graph for processes or the network for concept maps - and hence each item of the modelling language inherits the semantic of the corresponding mathematical concept. In addition or in parallel to this, there is a range of semantic injection from simple textual description to semantic lifting via annotation.

- Notation concerns the graphical representation of modelling language elements. Those graphical representation are mainly in form of graphical symbols. Principles of graphical notations have been elaborated by [19] with respect to the nature of the symbol, the ease of the understanding and the uniqueness of the expression. In total there are more detailed aspects that need to be considered when working on the concrete modelling language.

Aforementioned aspects are specified in form of a "model of a model", hence the common "meta-model". The meta-model defines mainly the syntax, semantic and notation of elements that contribute to the domain of the model, like the "start", the "decision" or the "end" of a business process. In addition to those domain specific elements, there are navigational elements that ease the use of the modelling language and enable an economy of modelling. A list of features to navigate, group or ease the modelling are typically grouped under this functional capability. In order to realize the conceptual meta modelling tool, there are additional concepts required that enable the realizations. Such features are typically not providing any additional meaning, but are necessary to map the conceptual meta model onto a technical meta model that can be performed within a modelling tool.

3.4.2. Modelling procedure

The Modelling Procedure defines the applied modelling technique by defining the steps - how the modelling method is used. The Modelling Procedure itself is influenced by internal and external factors. In case of external factors it has to comply with the imposed requirements like PA regulations that a change in the business process needs an approval by a responsible person. In case of the internal

factors it has to cope with the recommended modelling steps, expected tool functionality and common usage.

3.4.3. Mechanisms and algorithms

The Mechanisms and Algorithms specify the modelling functionality to create and process models. They are typically classified according to high level functional groups (a) visualization, (b) query, (c) simulation and (d) transformation of models. Beside the functional classification there is also the classification according the abstraction level, if a certain functionality is valid for all modelling languages (i.e. generic), or only for a specific modelling language (i.e. specific), or a combination of both (i.e. hybrid).

Algorithms are mathematically foreseeable like queries or simulations, whereas mechanisms are unpredictable in case of user interaction.
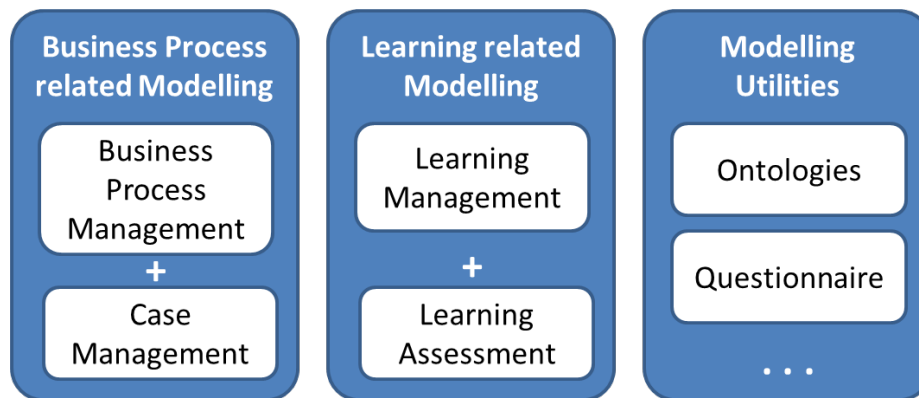
Figure 3.3: High Level Building Blocks of Learn PAd Modelling Method

3.4.4. High level Learn PAd modelling method

Based on the aforementioned Generic Modelling Method Specification Framework, the high level building blocks of the Learn PAd Modelling Method can be identified. Details on the modelling method are presented in WP3, but for completeness reasons some statements are elaborated.

The Learn PAd modelling method consists of a hybrid modelling approach; combining (a) business process related, (b) learning management related and (c) so-called modelling utilities together.

Figure 3.3 depicts current high level viewpoint on the Learn PAd modelling method, which is briefly elaborated with respect to aforementioned specification framework.

Business Process Related Modelling

The major aspect in business process-oriented learning is the appropriate representation of a business process within the public administration. Beside the typical standard approach in using BPMN 2.0 for covering the business process management, Learn PAd additionally requires to specify relevant knowledge and skill profiles. In particular the business goals, strategies and business motivations, the organizational structure, the data models and the IT system models are seen as the context of the business process model in Learn PAd.

In order to enable collaboration mechanisms for models on the Wiki platform, the corresponding concepts for such collaborative concepts need additionally to be reflected in the business process modelling language.

As Learn PAd deals with differently structure business process, ranging from well structure processes - that are typically covered in BPMN-like notations - but also weakly structured processes - that may be

covered in Case Management Model Notation CMMN - there is the necessity to cover hybrid modelling within Learn PAd.

Learning Related Modelling

Learning related modelling deals with the specification of learning goals, definition of the learning content and the teaching path in presenting the content in the ideal way for each individual learner. Typical aspects are learning goal, curricula, skill profiles, teaching content and the packaging towards a learning management platform. Current state of research is to continuously asses the learning progress and hence combines the teaching path with assessment models that specify the goals that need to be achieved and also the assessment method.

Depending on the level of detail, the learning management will be performed; the corresponding modelling method for learning management and learning assessment will be required. The ECAAD method combines both aspects hence provides a good starting point for reducing the modelling method to the required size for Learn PAd.

In case only minor elements are required, the learning related modelling may be merged into the business related modelling block. In that case, only few modelling classes and some additional properties will be used. Although those changes may be minor, they still change the BPMN 2.0 standard and hence need to be mention here as a so-called hybrid modelling solution.

Modelling Utilities

Modelling Utilities are modelling concepts that may or may not be used and hence can be flexibly added to the meta model. Current identified aspects are ontologies for semantically lifted log mining or questionnaires models for a model-driven development of tests. A loose coupling with the other building blocks has the advantage of providing a flexible modelling infrastructure that can be realized and applied in different level of complexities. The three dots indicate that there might by additional modelling utilities in the context of Learn PAd that need to be added.

Although a more detailed analysis on the modelling methods will be performed in WP3, they are quickly introduced here to better guide through those requirements they refer to modelling methods.

3.5. The Learn PAd Usage - USER SCENARIOS

The usage of the overall Learn PAd system is described in individual scenarios that have been collected in form of use case descriptions during a collection phase in the project and was grouped according the aforementioned high level reference system for knowledge management systems.

At this stage it has to be stated that we distinguish between the initialization phase and the operation phase. The initialization phase is concerned with the overall change management by introducing a learning system into the organization. Hence, current state of play is the participatory involvement of key knowledge worker, when setting up the overall system. As this is not different to any other change management when changing the socio-technical environment, there is no Learn PAd specific issue that needs to be considered.

The operation phase deals with the learning system that is in place at the public administration. The underlying method is a typical PDCA) cycle starting with:

1) **Plan:** The Evidence Centered Activity and Assessment Design (ECAAD) may be used as a basis to design the learning domain and the learning method. In the context of Learn PAd (a) the learning domain is the business process, (b) the learning activities and assessment methods all necessary descriptions on expert roles, simulation data and questionnaire creations, (c) the activity and assessment model integration and delivery are hybrid mechanisms to combine business process, learning activities as well as KPI and

2) **Do:** This phase describes the usage of the Collaborative Business Process and Knowledge Based Learning following the simulations, the recommendations for learning, enabling the knowledge sharing between civil servants and experts and enabling the tracking and assessing of learning goals.

3) **Check:** The check phase is concerned with the management feedback of the learner's results. First, learning assessment methods are applied such as observing the simulation sessions with log mining or checking the results with test-based questionnaires and second additional feedback is collected via comments or improvement suggestions from the learners

4) **Act:** In the context of Learn PAd this phase covers the consideration of the feedback and learning results to incorporate those findings into the business process and learning models. This refinement continues with phase (1) to realize a cycled approach.

Use case scenarios have been collected and use cases have been grouped according the aforementioned reference architecture and the aforementioned phases of the PDCA cycle. Hence (a) the Business Process and Knowledge Based Learning Modelling supports mainly the Plan phase, (b) the Collaborative Business Process and Knowledge Based Learning supports mainly the Do phase whereas (c) the Business Process Learning Knowledge Assessment supports mainly the Check-phase. The final Act-Phase is typically supported with a decision support tool and less with a knowledge and learning management system.

Based on the overall Learn PAd approach, the reference architecture and the use case description, the following roles have been identified. It has to be stated that this role-concept defines organisational responsibilities in order to enable the separation of organisational and technical concern; hence it is possible that one person fulfills more than one role.

Civil Servants are the targeted end users who should be trained and who should have the possibility to exchange their knowledge as well as contribute to continuously improve the system. The civil servant needs to support the activity of the PA. Civil servants are interested in learning what/how/when to do specific activities in order to fulfill the PA objectives.

Experts are identified knowledge worker, who have more rights to create, change and recommend content. The expert is generally a colleague of the learners which is expert and can provide support on specific topics that can refers to intra-organizational aspects as well as inter-organizational aspects. The expert is interested in providing support in order to improve their reputation within the community.

Coach deals with assessment and support of learners, especially the support and recommendations of learning assignments. They are users of the Learn PAd Platform (i.e. Civil Servant, Expert) that is responsible to define, and plan learning sessions for a group of learners (e.g. Professor)

Manager is the role that is concerned with the overall performance of the Learn PAd system, hence the way the business processes are presented and used, as well as the learning success of civil servants.

Modeller is responsible in correctly modelling business processes, learning activities, learning goals and KPIs. Actors in this group are interested in defining, possibly collaboratively, models that, among the possible usage, will be used for learning purpose. Modelers should also be able to introduce relations among different modelling aspects within the same organization. Models can refer to inter-organizational or intra-organizational aspects. Certainly these two kinds of models will be defined by different modellers.

Maintainer is a technical person, who takes care about the Learn PAd platform and all its interactions. The administrator of the Learning Platform, who is responsible to import new Business Processes, en/dis-able learning sessions with respect to some Business Process, add/remove users on the Platform, assign/revoke a role to a user of the Platform (i.e. Civil Servant, Expert, etc.).

In the following the use cases and their indicative dependencies with roles and high level building blocks are drafted, although this is only a high level presentation that aims to introduce the key behavior of the system and does not aim to explain each dependency in technical detail.

Figure 3.4 introduces the collected and grouped uses cases and drafts an indicative relation between use case, high level functional building block and potential role.
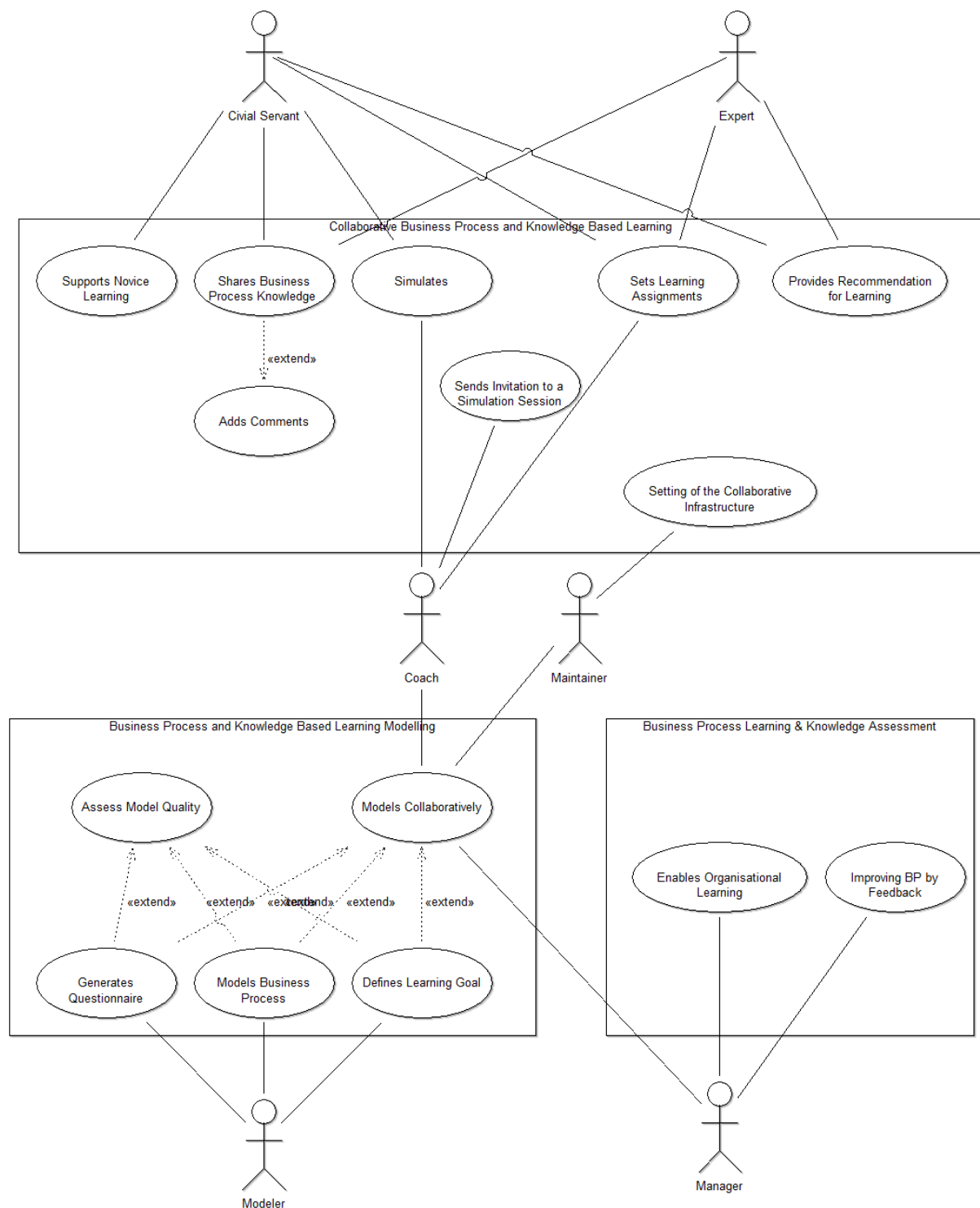
Figure 3.4: Use Case Scenarios

Use Case Name	Models Business Process
Pre-conditions	The expert is aware of the business process
Scenario:	This scenarios starts, when the Expert and Modeler start to model a new business process. They map reality to the concepts of ideal business processes. The expert defines required knowledge that is necessary for the execution of the business process. Additional criteria for roles, expert profiles, learning goals or key performance indicators are modelled. Simulation relevant or collaboration relevant properties may be added. Typically this use case consists of graphical and textual description of the business process. There are acquisition support assisting to import or collect information from the expert or IT systems, the design support for the graphical representation, the analysis or simulation of the model that checks its completeness, correctness and enable some estimations of the behavior. Finally this use case consists of export and documentation feature to hand-over the business process model to another part of the system.
Post-conditions:	A new business process with assigned knowledge artefacts is modeled.

Table 3.1: UC - Models Business Process

Use Case Name	Defines Learning Goal
Pre-conditions	The Manager is aware of the goals, the business processes are defined.
Scenario:	This scenario starts, when the Manager and the Modeler start to model the organizational and hence the learning goals. Following the goal-oriented learning paradigm the ultimate sense of the learning is that the workforce better achieve organizational goals by better performing the business processes. Hence manager and modeler define learning goals depending: 1) Customer Service: e.g. improve response time to customer requests, 2) Profitability: e.g. observing the budget allowance while limiting expenses 3) Retention: e.g. observing a problem with employee turnover, 4) Efficiency: e.g. increasing the cycle time of a business process
Post-conditions:	A new business process with assigned knowledge artefacts is modeled.

Table 3.2: UC - Defines Learning Goal

Use Case Name	Generates Questionnaire
Pre-conditions	The Coach is aware of the learning path, a set of learning goals associated with a business process are specified.
Scenario:	The scenario starts when a Coach decides to synthesize a new set of questionnaires from a business process model. This scenario can be activated both, before the learning platform has been initialized, and also online during its usage. Specifically, the generation of the questionnaires is performed by some component (i.e. Questionnaire Generator) or within the modelling tool. Successively the obtained questionnaire will be imported by the Coach in the running instance of the platform. The Coach decides to provide a new learning session, selects a business process model and configures a questionnaire. Relevant business process information is transformed into questionnaires. The Questionnaire Generator returns the set of questionnaires associated with their respective expected correct answers. The executable questionnaire is exported into the run-time system.
Post-conditions:	: a set of questionnaire, associated with their respective expected correct answers, is produced..

Table 3.3: UC - Generates Questionnaire

Use Case Name	Assess Model Quality
Pre-conditions	A business process model, a learning goal model or a questionnaire model has been defined
Scenario:	The scenario starts when a Modeller decides to check if the defined model satisfies given structural properties (deadlock, live lock, local live lock etc.) The Modeller asks the system to check the correctness of the model under development, by providing the system a formal representation, through a suitable transformer (to be defined). The system run the verification activities on the derived formal model and in case issues are identified, it (a) either provides information with respect to the violated property or (b) tracks back into the BP model the highlighted issue.
Post-conditions:	: Model quality assessment results are provided

Table 3.4: UC - Assess Model Quality

Use Case Name	Models Collaboratively
Pre-conditions	A business process model, a learning goal model or a questionnaire model has be modelled
Scenario:	The scenario starts when more than one modeler access the same model, e.g. an expert and a modeler are working on the same business process model, a manager or a modeler is working on the same learning goal model or a coach and a modeler are working on the same questionnaire model. Mechanisms such as commenting, versioning, contributing, task assignment or track changes are provided to support the collaborative editing of models.
Post-conditions:	Models have been collaboratively designed

Table 3.5: UC - Models Collaboratively

Use Case Name	Supports Novice Learning
Pre-conditions	All users have a profile containing their role, required and actual skills and the corresponding skill levels.
Scenario:	The scenario starts when a novice Civil Servant (i.e. a person with low skill level in all or areas or just the BP in question) wants to learn about a certain business process that he/she needs to perform. The Civil Servant selects a business processes and clicks on a task for which he/she'd like to explore details. The system opens a general description of the task, containing links to the most important resources (where the level of detail is adapted to the low skill level. The Civil Servant can navigate back and forth between the representation, the task descriptions and the linked resources at her own discretion. Alternatively, the Civil Servant can also "step through" the process, i.e. in each task description there is also the possibility to navigate to a subsequent task. In case of multiple possibilities (e.g. because of a decision gateway), a short interaction takes place, i.e. the system asks which decision is to be taken and then proceeds accordingly.
Post-conditions:	The Civil Servant has gained a rough understanding of the business process in question.

Table 3.6: UC - Supports Novice Learning

Use Case Name	Shares Business Process Knowledge
Pre-conditions	In the system, all users have a profile containing their role, required and actual skills and the corresponding skill levels.
Scenario:	The scenario starts when an expert encounters any of the following events; either the experts learns about a new law/regulation or he/she encounters an exception / special problem not yet described in the system or he/she finds a task description which is not correct according to her experience or is asked for help on a certain issue by a colleague. The expert either leaves a comment in the system describing the issue or changes the description or related elements of an activity (or other element), e.g. adds a resource, a checklist, an FAQ etc. In case the expert leaves a comment in the system describing the issue, the system asks her whether the comment should be taken up later by Organizational Learning. If so, she is asked to classify the new information according to the following categories; 1) information serving as guideline for future process executions 2) a change request having an impact on roles and responsibilities within the business process 3) a change request having an impact on the control flow of the business process The system stores the new information and visibly marks it as new Other Civil Servants who encounter the new information have the possibility to "agree" to a comment.
Post-conditions:	The new information is stored in the system. In case of leaving a comment in the system, the comment is scheduled for being reviewed in organizational learning.

<div align="center">**Table 3.7: UC - Supports Novice Learning**</div>

Use Case Name	Simulates
Pre-conditions	Business process models are deployed within the simulation environment
Scenario:	Civil Servant browses the registry of the public administration looking for a process that helps her performing her current task. Civil Servant searches for a pre-configured scenario. The Learn PAd simulator asks Civil Servant if Civil Servant would like a live simulation session with one of the following options: 1) Individual simulation, where all the other participants to the BP are simulated by mocks. 2) collaborative simulation, where all the other participants to the BP are played by other learners that would like to exercise with a simulation, 3) mixed simulation, where some of the participants to the BP are simulated by mocks, others are simulated by learners If the Civil Servant wants to have a live simulation session, the Learn PAd simulator instantiates the sub-process and opens a simulation window. Mocks generate the description of the user interface (i.e., forms) that should be presented to the user. The user fills the form with the requested data. Once the user is done the filled data is sent back to the simulation engine. Civil Servant starts reading the description and answering when needed to the asked questions. Each time Civil Servant validates an answer, an event is generated. The BP&Learner Monitor listens and interprets the non-functional (duration, wrong answer, etc.) events. The modelers of the BPs should identify a priori what are the learning-relevant events. The Learn PAd simulator asks Civil Servant if she wants to receive an evaluation of the simulation session. It displays to Civil Servant the report and suggestions for improvements of his/ her behavior in such situations.
Post-conditions:	The Civil Servant receives an evaluation report and suggestions in order to improve his/her skills.

Table 3.8: UC - Simulates

Use Case Name	Sets Learning Assignments
Pre-conditions	A BP has been uploaded in the learning platform
Scenario	The scenario starts when a Coach decides to assign a set of learning tasks to some Civil Servants. The Coach requests the platform to spread invitations about the assignment of a set of learning tasks to some Civil Servants. After selecting the relevant business process - e.g. in case of changes, or in case of focused learning - the coach defines learning assignments and has a monitoring, when and who performs the learning session.
Post-conditions	A set of Civil Servants receives the assignment of set of learning tasks and the coach can monitor the execution.

Table 3.9: UC - Sets Learning Assignments

Use Case Name	Provides Recommendation for Learning
Pre-conditions	All users have a profile containing their role, required and actual skills and the corresponding skill levels.
Scenario	The scenario starts while a novice Civil Servant is executing a certain business process and gets stuck in a certain task, requiring help or information. The Civil Servant chooses the business process from a list and navigates to the right activity. The Civil Servant sees a description of the task - tailored to the BP-specific skill level contained in her learner profile - including; (recommended) discretionary sub-tasks, checklists of resources and tools to use, an example of the result of executing the task, a list of common errors / FAQ Either the Civil Servant, by looking at the displayed information, already has enough information to solve her issue or Civil Servant requires still more information/help In case Civil Servant requires more help, she can highlight/select certain elements of the task description (e.g. one or two recommended resources and a corresponding sub-task - but the selection can also be empty) and ask the system for help - e.g. "I need help on this!" button. A dialogue appears where the Civil Servant is asked about some characteristics of the current BP instance that the system deems important to solve the issue. The system collects available suggestions based on the provided context and returns a list of possible actions like searching for 1) suitable Expert users who can help solve the issue, i.e. whose skills match the current context to a large degree, 2) additional information that can be retrieved/inferred from a larger knowledge base, using the context as a query/entry point (e.g. a filtering of documents could happen based on CMMN rules whose precondition matches the current context), 3) cases, e.g. database records from an external productive system, that match the current context (e.g. via case-based reasoning) 4) a filtered list of discretionary (sub-)tasks which are applicable in the current context The user chooses one of the recommended actions; if the required information cannot be retrieved through this recommendation, the user tries the next one.
Post-conditions	The Civil Servant has solved the issue and is able to continue executing the business process.

Table 3.10: UC - Provides Recommendation for Learning

Use Case Name	Setting the Collaborative Infrastructure
Pre-conditions	A BP has been designed, all the wiki documents matching the BP, all the required artefacts that are needed for the BP simulation have been generated (see Scenario Export of BP Modelling Artefacts), and the scenario on quality verification of the BP is specified (see Scenario Structural Correctness Assessment)
Scenario	: The scenario starts when a Modeler notifies a Maintainer to import new Business Processes. A Maintainer requests the platform for the import of a new Business Processes. The correct business process model including Learn PAd specific information is selected, Wiki page configurations are set and simulation information is checked and adapted. The whole package is copied into the collaboration platform and the necessary import, notification and configurations are performed.
Post-conditions	A new business process is enabled in the platform

Table 3.11: UC - Setting the Collaborative Infrastructure

Use Case Name	Adds Comments
Pre-conditions	A business process has been modelled.
Scenario	The scenario starts when an Civil Servant or an Expert realizes that some part of the business process model can or must be improved either because of a new law/regulation, or a special case is not yet described in the business process. The Civil Servant requests for the creation of a new feedback for the Model Maintainers. The user comments the business process in a text area and integrates hyperlinks, documents or picture when necessary. This comment is on the one side visible as an additional content in form of aforementioned use case "Shares Business Process Knowledge" but also establishes a sort of issue tracking system that is assigned to manager, maintainer or modeler. Hence the user is aware of the status of her change request, and will be informed, in case the issue is solved.
Post-conditions	A new feedback on the model is stored in the platform and is kept track on the status change.

Table 3.12: UC - Adds Comments

Use Case Name	Sends Invitation to a Simulation Session
Pre-conditions	A business process has been uploaded in the learning platform and profiles of learners are defined.
Scenario	The scenario starts when a Coach decides to suggest a new simulation session for some Civil Servants. The Coach requests the platform to spread invitations to a new simulation session for selected Civil Servants by first selecting the business process and second by selecting the learners. After confirming the invitations, notifications are distributed and the Coach can monitor the progress of the learning activities.
Post-conditions	Selected Civil Servants receives an invitation to start a new simulation of a business process

Table 3.13: UC - Sends Invitation to a Simulation Session

Use Case Name	Improving business processes by feed-backs
Pre-conditions	During Knowledge sharing, some Expert users have left comments on how to improve the business processes
Scenario	The scenario starts , when the a maintainer update system according to recommendations by experts. A Maintainer opens a report module to receive a report of all the relevant comments (change requests) that have been left in the Wiki by experts during Knowledge sharing. The report: (1) shows recommended changes by type of impact, (2) arranges expert recommendations by similarity/topic (3) ranks topics higher that have many associated recommendations, (4) ranks expert recommendations higher that many users have "agreed". Depending on the comments the manager decides, if the modeler, the maintainer or an expert is needed to perform the improvement steps. This is typically seen as the ACT phase.
Post-conditions	Selected Civil Servants receives an invitation to start a new simulation of a business process

Table 3.14: UC - Improving Business Processes by Feed-backs

Use Case Name	Enables monitoring of goal achievement
Pre-conditions	Results of learning and simulations sessions are stored
Scenario	The scenario starts, when the manager and / or coach imports the monitoring data of the simulations and learning sessions. The Coach filters the data according key performance indicators with respect to achievement of learning goals, the manger filter the data according key performance indicators with respect to business process improvements. The way, how to present personal data, especially the achievements of learning goal must be handled with appropriate privacy. Key performance indicators may depend on business process level, where improvements or learning achievements per business process are defined. Dashboard statistics and key performance indicator fulfillment support the Manage and the Coach in enabling organizational Learning
Post-conditions	Learning experiences from users and the organizational evolution is assessed and is made visible for decision making.

Table 3.15: UC - Enables Monitoring of Goal Achievement

4 Learn PAd Requirements

The following tables present the list of requirements that have been selected after the analysis phase and that are currently considered the most stable/relevant for the Learn PAd system. The numer of requirements was reduced by almost an half to include just those requirements considered relevant thanks to a wide consensus within the consortium. Before listing the provisionally accepted requirements the requirement attributes reported in this document are shortly illustrated:

- Id: The unique id is an index number and in case a requirement had been split during the analysis pahse, it is added with an alphabetical extension.

- Title: The title is a descriptive name of the requirement that had been added during the analysis to ease the comparison of requirements.

- Description: The description is provided by the author of the requirement and may be detailed during the analysis or extended during a requirement merge.

- Justification: The justification is provided by the author of the requirement, in case additional aspects need to be elaborated.

- Taglist: In addition to the aforementioned four dimensions, each author had the freedom to add additional keywords in the taglist. Used tags permit to relate requirements with each otehr and to better clarify their possible area of influnce.

- Type: The type is either functional or non-functional

4.1. The Learn PAd System - PARADIGM

Id	Title	Description	Justification	Taglist	Type
30	Guidelines in form of KPIs for assessing Model-Quality	The system shall enable to specify KPIs for the process elements in a guided way	Even though the evaluation of quality attributes can be an automatic process, the selection of the quality attributes to be evaluated against models and contents has to be also manual. In other words, from a repository of quality attributes, the modelling or business process experts must have the means to select the attributes that they want to be evaluated	[Documents Quality, Models Quality, Models to Documents Consistency, Project, Quality, WP4]	Functional
34	Coherent levels of Abstractions	Modelling and learning platform should share coherent levels of abstractions for specification and implementation to allow integrated verification properties.	Modelling and learning results in different artefact that has to face with common issues. This needs reflection in modelling guidelines to achieve appropriate level of detail.	[Abstraction, Learners Evaluation, Learning, Quality, WP4]	Functional
39	Learning Evaluation	The system should give BP learners feedback on their learning progress	In a learning process, feedback is important for learners (their level, their errors, their good moves). For example, dashboards with results on questionnaires, basic statistics on simulations, etc.	[Learners Evaluation, Learning, Skills profiling, WP3]	Functional
54	Education and training shall be traced	Education and training shall be traced		[Learners Evaluation, Learning, Skills profiling, Traceability, WP2, WP3, WP4]	Functional
164	Different Expert Levels on Feedback	The system should include mechanisms permitting to identify great contributors	In order to engage contents providers it is important to have the possibility to recognize civil servants which contribute for the benefit of the community. At the same time the quality of the produced contents should be monitored.	[Learners Evaluation, Ranking, WP2, WP5, WP6]	Functional

Table 4.1 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
165	Learners Motivation	The System should have a mechanism that reward users for completing an activity or for reaching a good score in learning. The System should send motivational/stimulation messages to the users in order to invite them to improve score and level.	The PA are usually composed of person that are afraid of novelty, demotivated by bureaucracy and not favourably disposed/friendly with the technology innovation	[Learners Evaluation, Ranking, WP2, WP5, WP6]	Functional
172	Roles and Actors	The system must permit to identify at least 3 major end-user categories: learners, domain experts (BP Provider or content provider), administrators (users & system configurations)	The system must include/model entrance test to categorize the level of the learners (e.g. Advanced, Good, Basic). The system shall provide each learner with a profile showing summary of his learning and contribution to knowledge building, most visited knowledge items, etc. role administration is needed in order to enable different type of users to access different functionalities and different learning contents. Each learning sessions must be associated with a "coach". In other words, a coach is a users of the system that is responsible to define, plan, and schedule learning sessions for a group of learners (e.g. Professor).	[Learners Evaluation, Roles and Actors, WP2, WP3]	Functional
256	Learning and Business Process Context	Seamless integration of learning into daily work. The learning process has to be integrated into the business context.	Learn PAd fosters "learning by doing", hence learners should ideally see no difference between the working and the learning environment.	[Execution Environment, WP5]	Functional

Table 4.1 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
264	Learn PAd-System: Activity Log	The system must be able to record who does what, namely it must be able to record all the changes of a content made by the different providers.	The system shall log activities (viewing, editing) related to knowledge items (such as a task description). The system shall make this information available to learners' community. It is need to trace all the changes/updates of a learning content made by the different providers.	[Learners Evaluation, Track Changes, WP2, WP6]	Functional
193c	Learning Processes for different Learner Profiles	The system must be able to derive the learning process differently for the same training module (levels of learners)	also the preparation level of learners should be taken into consideration: expert users could skip some modules or could begin the examination of a process from an advanced chosen point of entry	[Learners Evaluation, Learning Styles, Skills profiling, WP2, WP3, WP6]	Functional
245a	Learning Process Monitoring	The system must evaluate thanks to a processor if the learners are well following the learning process.	Following the actions produced by the learners while doing the learning process enables the system to draw the users behaviour in several conditions. The Learn PAd system must be able to observe the process and to evaluate at the end (or at runtime) if the correct process is being achieved or not. KPI can be exploited to that end.	[Learners Evaluation, Ranking, WP6]	Functional
50b	KPI-Models for assess Model-Quality Quality attributes SHALL be defined for both wiki pages and business processes	This requirement is in line with the DOW. In particular, according to the WP4 description we will have to define mechanisms for assessing the quality of both models and contents.	Since they are different kinds of artefacts, it will be necessary to understand what are the quality attributes that make sense for wiki pages and those for business processes.	[Documents Quality, Models Quality, Models to Documents Consistency, Quality, WP4]	Functional

Table 4.1: Requirements regarding to Learning Paradigm

4.2. The Learn PAd Platform - TECHNOLOGY

4.2.1. Knowledge, Learning and Business Process Context

Id	Title	Description	Justification	Taglist	Type
68	Keyword based search	The system shall provide means to keyword based search on the wiki pages	Since any user can contribute to the wiki page, we expect the content of the pages to increase in a relevant way. Therefore, a system to search among pages and, possibly, also models, is required. An indexing and searching mechanism can be used by people who search for a procedure but do not know the specific name of such procedure.	[Content Organization, Documents Quality, Evolution, Learning, Search Engines and Navigation, Traceability, WP2, WP5]	Functional
85	BP Modelling: Process Documentation and Interaction	The system should allow access to model base / business processes using different channels (direct->within tool, external->mobile)	There will exist different settings where the users of Learn PAd will interact with the system - therefore we should delivery different means of interactions (rich client, simple mobile interfaces, etc)	[Execution Environment, Modelling, WP2]	Non-functional
249a	Collaboration Mechanisms	The system should include mechanisms for social co-operation (like chat, tagging etc.) among the civil servant willing to contribute to the description of a process model	Letting users to contribute to community's contents in a social environment (chatting, tagging, quoting, liking, using emoticons, adding text and multimedia and so on) makes the learning process nicer and emotionally more effective	[]	Functional

Table 4.2: Requirements regarding to Knowledge, Learning and Business Process Context

4.2.2. Collaborative Business Process and Knowledge Based Learning

Id	Title	Description	Justification	Taglist	Type
87	Collaboration Mechanisms	The system must provide a way to discuss interactively using comment based mechanisms on each content defined by the community	Sometimes it will be unclear how to adjust / improve contents and an interactive forum would be a good addition to come up with a proper resolution in the contents.	[Cooperation, Execution Environment, Modelling, WP2]	Functional
213	Integration into existing systems	The system should provide interoperability with existing systems that are actually used in public administrations by civil servants. This because learners must practice on the real UIs that he/she will see in his/her daily job	A civil servant that is learning some kind of procedure, at some point, he will have to interact with actual information systems in the public administration (e.g., by entering data through some user interface). This should be part of the learning process, i.e., showing the civil servant how to actually use the information system (and its user interface) in order to complete tasks (e.g., entering the data provided by a citizen on paper into the information system, or performing queries to retrieve some kind of information)	[Execution Environment, Learners Evaluation, WP6]	Functional
255	Learners Collaboration	Learners should be able to communicate and to exchange opinions		[Cooperation, Learners Evaluation, WP2, WP3]	Functional
149	Learn PAd platform installation and evolution	The system should allow quick installation of a Learn PAd platform suite with basic functionalities. Nevertheless easy extensions of supported meta model, corresponding functionality, and integration of further components according to the overall architecture.	We should have an easy to install package for the end users (domain experts) but also have a package where experienced users and/or service providers can interfere with the meta model and also add their own objects and/or functionalities.	[WP2, WP3]	Non-functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
199	Learn PAd: Privacy of Learners Log Data	Logs should be audited respecting the privacy of the learners	Both the tracking and monitoring part of the system should consider privacy issues about both the learning activities followed by the learners and the score of their results (i.e. testing, and simulations)	[Access Control, Learners Evaluation, WP6]	Functional
94	Roles and Profile	The system must provide assessment instruments to test the knowledge level of a learner	The system must be able to provide learning facilities to their users (i.e. courses, tutorial, simulations). In addition it must also be able to submit tests (e.g. questionnaires) to them form which ground part of the knowledge of the learners.	[Learners Evaluation, Learning Styles, Skills profiling, WP5, WP6]	Functional
11	BP-Model and Wiki Alignment after Changes	The quality of the wiki shall be assessed after changes in it by the users, modified wiki contents shall be checked against the BP models	The quality of the wiki might change after a modification. Since we foresee both (1) quality evaluation based on the feedback of the user and (2) quality evaluation based on the consistency between models and wiki pages, here we highlight the fact that the quality check after changes on a wiki page can be performed only through the second approach for quality evaluation, since the evaluation of other users might not be available right after the application of the modifications.	[Documents Quality, Evolution, Models to Documents Consistency, Quality, WP3, WP4]	Functional
8b	BP-Model Feedback History Log	The system MUST provide the means to interactively refine models and wiki pages and keep track of the decisions made during revisions by the involved agents	The definition of models and wiki pages is an iterative process. Consequently it's a mandatory requirement for the system to provide the means to refine models, keep track of the modifications done, and somehow propagate such modifications to corresponding wiki pages.	[Evolution, Modelling, Skills profiling, WP2, WP3, WP5]	Functional
77b	BP-Model: Feedback on Quality	The system shall enable users to feedback on usability of the models represented as Wiki pages.		[Models Quality, Quality, Roles and Actors, WP4]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
93	Collaboration Mechanisms	System must include some collaboration mechanism to enhance the collaboration work between the Learn PAd users when designing end executing the business processes.	Different tools and options can be used (SMS, notification directly from model, model discussion in form of wiki pages) to bridge the gap between different groups of Learn PAd users.	[Cooperation, Modelling, Quality, WP2]	Functional
249d	Collaboration Mechanisms	The system should include mechanisms for social cooperation	Letting users to contribute to community's contents in a social environment (chatting, tagging, quoting, liking, using emoticons, adding text and multimedia and so on) makes the learning process nicer and emotionally more effective	[]	Functional
15	Collaboration Mechanisms between Content and BP expert	When content producers check the produced content they should ask BP experts in case of difficulty to solve the problem. There is a validation workflow actors should follow.		[Cooperation, Documents Quality, Learning, Quality, Roles and Actors, WP2, WP3, WP4, WP5]	Functional
187b	Content - Search	The system should guide users to relevant contents using structured features (a search engine) to find appropriate contents, and not only view or help on line	As learning experience is modelled in a sort of workflow, it should be useful for learners to jump directly to certain end or middle points of the BP, not considering the whole path	[Learners Evaluation, Search Engines and Navigation, WP2, WP5]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
23	Content Creation Interface	The system must provide user interface mechanisms to assist users in producing resources	When an agent is creating or completing a resource, he should be constrained in the editing system. This way, he fill follow guides which will result in a homogeneous quality of resources in the database. Here is a few ideas of what kind of constraints (mainly UI at this time): * Propose template for resources * Suggest a common jargon when the system see the agent is using a synonym * Suggest to contact other agents that may have create similar resources	[Accessibility, Documents Quality, Modelling, Models Quality, Models to Documents Consistency, Quality, WP2, WP3, WP4, WP5]	Functional
115	Content Filtering	The system shall enabling learner to filter what kind of information he wants to see, e.g. show or hide documents or business rules, etc.		[Modelling]	Functional
105	Content Governance and Protection	The system should enable specifying which information can be changed/modified in the knowledge base and which cannot.	Some of the knowledge information will be derived from model and should only be modified their by appropriate people to ensure proper governance and compliance.	[Cooperation, Modelling]	Functional
203	Content Governance and Protection	The system must protect the access to information so that only authorized users can access to a given set of data	This is related to roles in the public administration. Civil servants that are learning might be evaluated by their managers, so only managers must be able to access data related to what the civil servants are doing (e.g., results of the assessments of their acquired knowledge) It should not be possible, for example, for a civil servant to look at the results of his colleague.	[Access Control, Learners Evaluation, WP2, WP3]	Functional
260	Content Governance and Protection	The system must provide a mechanism that allows only the authorized users to modify contents.	A policy is needed to define who (which kind of user, for instance professor or learner) can read and/or modify which content.	[Access Control]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
118b	Content Role Based Views	The system should provide the possibility to switch views for specific viewpoints. For example an expert business user might be interested on other aspects or different level of granularity than a novice user.	Role-based, views on content could reduce complexity and enhance user friendliness.	[Abstraction, Modelling, Roles and Actors, WP3]	Functional
67a	Content Tagging	The system shall provide tagging procedures to categorize the wiki contributions	Tags can be useful to classify the contributions and visualize solely the contributions with a specific tag. Example tags could be change request, suggestion, law integration, model refactoring, example case (for example, of someone wishes to gives an example on how to implement a certain activity of the BP in practice).	[Content Organization, Cooperation, Evolution, Learning, WP2, WP3, WP5]	Functional
62	Content Traceability	The system shall enable logging of the wiki documents editing	We have to keep track of the changes to the wiki document, in order to revert the documents to previous versions when needed, and to identify the people who changed the documents. The goal is identifying experts for the specific wiki page.	[Documents Quality, Evolution, Quality, Track Changes, WP2, WP5]	Functional
207 a	Content Types	The system must support different types of contents (video, text, etc.) and access to external services (e.g. chat)	The system must be able to offer the needed explanation about a learning process or step using visual or audio content. A learner must be able to access to means for having assistance during the learning process, these can be an access to a conf call connection, a mailer, an enterprise network, etc.	[Content Organization, Learners Evaluation, WP2, WP3, WP5]	Functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
72b	Different Expert Levels on Feedback	The quality score of wiki pages shall be balanced according to the level of expertise of the user	If a user is not an expert could not understand some aspects of the wiki pages, and give quality evaluation feedback that are not appropriate. However, the judgement of non-expert has to be taken into account. A possible solution could be aggregating the evaluations between Experts evaluations and Non-experts evaluations, like the Critics and Audience in MyMovies.	[Cooperation, Documents Quality, Models Quality, Quality, Roles and Actors, Skills profiling, WP4]	Functional
194b	Different Knowledge Entry Points	The system should support different types of access to the knowledge in the system.	Each individual and each situation/context require different kinds of access to knowledge. Usually, the search strategy depends on the specificity of the information need - if the need can be very precisely articulated, a natural language query might be chosen, if the need is vague, one might prefer a browsing strategy. There are also very individual personal preferences regarding search strategies. All of these should be supported by the system. Sample: e.g. via navigation (starting with the process model), via expert retrieval, via other entities, via tag clouds, via keyword search, via recommendations etc.	[Accessibility, Content Organization, Learners Evaluation, Learning Styles, Search Engines and Navigation, WP2, WP5]	Functional
66 b	Expert Profile	The system shall classify the experts by performing a profiling of the content producers (documents and BP models)		[Cooperation, Documents Quality, Learners Evaluation, Learning, Models Quality, Quality, Roles and Actors, Skills profiling, WP2, WP3, WP5]	Functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
63b	Expert Roster	The system shall have the ability to suggest specific experts to specific learners	Experts can give advices to learners for a specific PA procedure, but also for understanding a model associated to a specific procedure.	[Cooperation, Learning, Skills profiling, WP2, WP3, WP5]	Functional
64a	Expert to Domain Classification	The system shall provide a method to be able to map experts according to their contribution to the knowledge base (documents and BP models)	The classification of experts is useful to suggest experts to learners and to understand who can change the model of a procedure, or the wiki content of the same procedure, when change requests are issued by the community or by the regulations that are represented in the BP models and associated wiki pages.	[Learners Evaluation, Learning, Skills profiling, WP2, WP3, WP5]	Functional
58	Feedback History Log	The Experts shall have notifications of issues submitted by the learners for a specific BP	Learners may raise problems/incoherences in BP models to BP experts; the BP experts should be aware of these problems and they should have a notification tool (email or wiki dashboard or chat communication or etc.)	[Cooperation, Learning, Roles and Actors, Skills profiling, WP4, WP5]	Functional
101 b	Feedback History Log	The system shall permit to navigate the history of the BP, and shall report the events that changed the model and the causes of the changes (laws, rules, final user's need)	The goal is keeping track of the evolution of the system, in order to automate some very frequent modification. But also to understand if the interpretation of some law or rule has been correctly represented in the BP: this helps identifying laws, regulations and rules that are more tricky to model and therefore their model needs to be changed more often. Moreover, it also helps identifying modelling constructs that are not easily understood by a user (if the modification is performed because the learner required that). In other terms, tracking changes helps identifying the weak points of the models, both from the process point of view and from the modelling point of view.	[Modelling, Track Changes, WP3, WP5]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
236	Feedback Interaction with Process Documentation	during a training session learners must be able to propose a real situation which is supposed to be mapped by an appropriate theoretical process, in order to reveal exceptions and possible different forks on the flow chart, consequently suggesting a possible redefinition of the BP	It's a feature to enable final users to write comments in a more interactive way, in each point of the BP, to observe errors or variability issues	[Cooperation, Learners Evaluation, WP5, WP6]	Functional
235	Frequently Asked Learners Questions	The system should support learners in creating open questions which other people can answer	The idea is to include means such as Stack-Overflow	[Cooperation, Learners Evaluation, WP2, WP5]	Functional
243b	KPI-Model: Learning Logging	The system must support KPI for assessing learners and learning processes.	Key Performance Indicators represent an efficient means for evaluating applications, services, and even learners. In each case we may state a list of threshold values that represent the desired values. After monitoring the enacted processes and the learners behaviour the system and more precisely the governance part must be able to assign specific marks and notations.	[KPI, Learners Evaluation, WP2, WP3]	Non-functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
21b	KPI-Models: Quality of Content	The system must use a clear notation to prioritize the needed quality improvements of content.	The quality of a resource can not be perfect. It is essential the system filters and orders the resources in term of quality. A clear display (colour, font size, status categories, score, ...) of that will reinforce the perception of this quality by agents.	[Cooperation, Documents Quality, Modelling, Models Quality, Models to Documents Consistency, Quality, Ranking, Search Engines and Navigation, WP4, WP5]	Functional
18	Learners Feedback on Content	The system shall provide a rating system, every agent shall provide feedback on the quality of every resource (social evaluation of quality)	It could be difficult to objectively evaluate a resource because of the interpretation of an evaluator. It may be difficult to evaluate automatically a resource (need a semantic analysis which is research). We could use the way that social networks evaluate things with a kind of public vote to evaluate the quality of a resource.	[Cooperation, Documents Quality, Models Quality, Quality, Ranking, WP4, WP5]	Functional
56	Learners Feedback on Content	The learners shall be able to give evaluation to the learning content (models and documents)		[Cooperation, Documents Quality, Models Quality, Quality, WP2, WP3, WP4, WP5]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
71	Learners Feedback on Content	The system shall provide a manual way to assess the quality of the wiki documents	Default quality attributes of a natural language document can be automatically checked (e.g., absence of ambiguity, readability). However, the human evaluation is needed in order to identify other quality attributes that a document shall exhibit in the context of the project. Therefore, the users shall provide feedback on the content of the wiki documents produced, to identify the pages with lower quality and the pages with higher quality. This information can be used to improve existing pages, and to give additional guidelines for writing pages. The learners shall be able to give advices on a PA process that is hard to implement or to follow.	[Cooperation, Documents Quality, Quality, WP4]	Functional
227	Learners Feedback on Content	The system must support means for expressing opinion about contents	Feedback and comments from the learners are useful in order to improve learning artefacts (e.g. manuals, tutorials, etc.). Also they are meaningful in order to establish the relevance of both artefacts and content producers.	[Cooperation, Learners Evaluation, WP2, WP3, WP5]	Functional
231	Learners Feedback on Content	The system must provide a mechanism for recording learner feedback.	The learner feedback (positive or negative) on a specific content must be recorded and made available to other learners. This could help the learner to assess how much that content is trustable.	[Cooperation, Learners Evaluation, WP2, WP6]	Functional
216b	Learning Categories	The system should support categories of learning sessions (i.e. optional/mandatory/recommended)	Such categorization could help learners in organize their tasks	[Execution Environment, Learners Evaluation, WP3, WP5, WP6]	Functional
103a	Learning Feedback	The system shall log learners' activities (reading/contributing, etc).	The system shall make this information available to the learner community. DoW states that leaders will appear naturally based on their contributions.	[KPI, Modelling, Ranking, WP6]	Functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
44	Legacy Application Integration	The learning system should be based on the learning systems already available in public administrations	It is important that the learning system will be adopted in public administrations and used by public employers, so the innovation path in public administration should be based on evolution.	[Learning, Learning Styles, Project, WP3]	Functional
145	Roles and Expert Levels Assessment	The system shall provide a way to formulate tests and questions for assessing learners' knowledge.		[WP6]	Functional
181	Roles and Expert Levels Assessment	The system must permit the definition of questionnaires for assessing the knowledge acquired by civil servants	Assessing the knowledge acquired by a civil servants can be done by using questionnaires that can be derived either directly from the business process models, or even created by a user (with the right role) for a specific purpose. The system must support both of them in order to give user the possibility to assess the acquired knowledge by civil servants as much completely as possible.	[Learners Evaluation, Questionnaires, WP2, WP3, WP5]	Functional
171	Roles and Profile	The system must permit to define roles and assign users to them. A role is something like knowledge expert, public servant, system administrator, etc.	Assigning users to roles allows a better management of the responsibilities and access to data and functionalities provided by the system.	[Learners Evaluation, Roles and Actors, WP2, WP3]	Functional
254	Roles and Profile	The system must manage groups of learners.	Manage group of people with the same learning objectives	[Cooperation, Learners Evaluation, WP2, WP3]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
7 b	Roles and Skill Profile	The learning system should support different learning profiles.	The system should be able to model profiles. People that will learn based on the proposed solution could be different in term of process execution expertise, so it is important to consider that different abstraction levels of the same Business Process should be considered. Having a profile of the final user that will refer to the BP, could help learners in having a better comprehension about the overall process the BP models	[Learning, Learning Goals, Roles and Actors, Skills profiling, WP2, WP3]	Functional
168	Track Changes: Content	The system should be able to nicely show visually the differences between artefacts (models, content, etc)	In order to better track changes to system managed artefacts it is good to show users what changed exactly. This will allow the user to better understand what is the history of the artefact and also what are the reason why certain changes. have been applied. Ideally this is about all the artefacts handled by the system, including models and content related to the models whenever they are handled directly by a component fully integrated in the system. This might not be the case if we integrate external components.	[Learners Evaluation, Track Changes, WP2]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
168	Track Changes: Content	The system should be able to nicely show visually the differences between artefacts (models, content, etc)	In order to better track changes to system managed artefacts it is good to show users what changed exactly. This will allow the user to better understand what is the history of the artefact and also what are the reason why certain changes have been applied. Ideally this is about all the artefacts handled by the system, including models and content related to the models whenever they are handled directly by a component fully integrated in the system. This might not be the case if we integrate external components.	[Learners Evaluation, Track Changes, WP2]	Functional
239	WIKI Content Traceability	The system must be able to collect and store all the activities of the content producers.	The system must be able to record who does what, namely it must be able to record all the changes of a content made by the different producers.	[Learners Evaluation, Track Changes, WP2, WP6]	Functional
161	Ranking	The system should run some ranking mechanisms	The ranking mechanisms will support to the identification of experts, and it will also leverage meritocracy in the community.	[Learners Evaluation, Ranking, WP2, WP5, WP6]	Functional
22	Content Governance: Automatic Runtime Checks of Content Quality	The system shall perform runtime checks on the linguistic and structural quality of the Wiki documents.	The quality shall be checked at runtime, so that recommendation on how to improve the quality of the Wiki documents can be issued to the user during the editing phase.	[Documents Quality, Quality, WP4]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
139b	BP-Modelling Method: CMMN Extension	The BPMN 2.0 meta-models should be extended to CMMN (Case Management Model and Notation) in order to support agile processes.	The Case Management Model and Notation (CMMN) specification expands the boundaries of what can be accomplished with BPMN by incorporating knowledge worker driven adaptive work. Now customers can address a much broader spectrum of processes using a combination of BPMN and CMMN, said Ralf Mueller, Architect at Oracle and co-chair of the CMMN Finalization Task Force. The Case Management Model and Notation (CMMN) is available at the OMG web-Site: `http://www.omg.org/spec/CMMN/1.0/Beta1/`	[Metamodel, Modelling, WP3, WP5]	Functional
130	KPI Logging	The system shall enable augmenting process information with key performance indicators retrieved from actual performance data.	It would be good to see real values for various process/task properties such as average duration, defect ratio, etc. Following the actions produced by the learners while doing the learning process enables the system to draw the users behaviour in several conditions. The Learn PAd system must be able to observe the process and to evaluate at the end (or at runtime) if the correct process is being achieved or not. KPI can be exploited to that end.	[KPI, Metamodel, Modelling, WP3, WP6]	Functional
217	Learning Process History	The system should permit to persist the state of learning process so that it can be resumed at later time	Learning sessions might be quite long, and civil servants might not be able to complete them in a single run. Having the opportunity to pause and resume the session will improve the learning experience.	[Execution Environment, Learners Evaluation, WP2, WP6]	Functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
209b	Learning through Simulation	The system must be able to simulate the behaviour of some participant in the BP	During the training a learner may need to interact with some other participant of the BP. The simulation environment must provide some features so that the learner can practice in a realistic environment. Thus it must support the synthesis and the engagement of mocks, where each of them (even partially) conforms with the behaviour of a real participant.	[Execution Environment, Learners Evaluation, WP6]	Functional
241	Simulation History	The system must be able to report logs/traces/history about the simulation activities.	The results of the consecutive simulation activities by the learners need to be stored in the system and used for evaluating learners (namely the increasing of their knowledge). including 252: Historical records enable to monitor the progress of each learners across the various sessions including 253: The system must keep track of historical records about the results scored by the learners compiling their tests (i.e. questionnaires)	[Execution Environment, Learners Evaluation, WP6]	Functional

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Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
208	Simulation Environment	The synthesized mocks should conform to the Input/output interface of the system they are replacing	During the training a learner may need to interact with some other participant of the BP. The simulation environment must provide some features so that the learner can practice in a realistic environment. Thus it must support the synthesis and the engagement of mocks, where each of them (even partially) conforms with the behaviour of a real participant. In this specific context, it is required that the synthesized mock at least conforms the replaced system by using the same interfaces, and providing a behaviour that conforms to some functional contract (for instance, it never violates any guard of a the corresponding state machine). Furthermore, when someone is using the stub, it is able to detect a violation of its functional contract by that user. Respecting the extra-functional contract means that the stub meets the	[Execution Environment, Learners Evaluation, WP2, WP6]	Functional
215	Simulation Environment	The system must include the synthesis of mocks (of the external services) for simulation purposes	During the training a learner may need to interact with some other services of the BP. The simulation environment must provide some features so that the learner can practice in a realistic environment. Thus it must support the synthesis and the engagement of mocks, where each of them (even partially) conforms with the behaviour of a real external service.	[Execution Environment, Learners Evaluation, WP6]	Functional
225	Simulation Environment	The system enables a Test Run of a Business Process	During the simulations, the BP should be actually run by some engine.	[Execution Environment, Learners Evaluation, WP2, WP6]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
210	Simulation Environment: Usage	The system must support the execution of several simulation sessions	The system is concurrently accessed by learners	[Execution Environment, Learners Evaluation]	Functional
13	BP-Wiki and BP-Model alignment	The system should provide wiki description that describe whole model potentially split into multiple pages.		[Content Organization, Documents Quality, Quality, WP2, WP3, WP4]	Functional
14	BP-Wiki and BP-Model alignment	The system should automatically generate and format at least a main entry page in the wiki for each process model	The entry page will be the starting page to contribute and study a process.	[Content Organization, Documents Quality, Models to Documents Consistency, Quality, WP2, WP3, WP4]	Functional
99	BP-Wiki and BP-Model alignment	The system shall provide a manageable approach, supported by automatic analysis tool, to (co)evolution of models and textual contents.	It is necessary to support scenario when the process structure will change in the model and knowledge base needs to be updated while maintaining textual content contributions. Such a change is unlikely to be handled automatically, but a manageable approach should be suggested and enabled.	[Evolution, Modelling, WP3]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
147b	BP-Wiki and BP-Model alignment	The system must check the coherence between business process models and the related content structure	It is important that graphical models and contents are aligned	[Documents Quality, Modelling, Models Quality, Models to Documents Consistency, WP3, WP5]	Functional
145	Roles and Expert Levels Assessment	The system shall provide a way to formulate tests and questions for assessing learners' knowledge.		[WP6]	Functional
234	Help and Assistance	The system should provide an interactive method for getting help so that people who are stuck on a task can understood how to proceed	Having a way to get help in difficult situations might help people to progress in their learning experience.	[Cooperation, Learners Evaluation, WP2, WP6]	Functional
57a	Help and Assistance	The system shall provide information to let the learners contact the identified experts of a specific BP	In the description of a process or its related activities the system should include references to identified experts and how it could be possible to contacts them	[Learning, Roles and Actors, Skills profiling, WP2, WP3, WP4, WP5]	Functional
43	Learning Sub-System	Two system should be considered one for modelling and one for learning	The target of the modelling and learning tools are different, so according to specific stakeholder they have to implement different aspects.	[Learning Goals, Modelling, WP2, WP3]	Functional
204	Learn PAd-System: Access Control	The system must provide mechanisms for access control	Preventing attempts to page accesses from all	[Access Control, Learners Evaluation]	Functional

Table 4.3 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
205	Roles and Responsibilities	The system should foresees the possible integration with identity management framework in order to be able to deal with different users: defining user groups/roles, mapping functionalities (columns) and contents (rows) and relative permissions for each user group and for each user, using standard authentication/authorization framework (e.g. SAML federation)	User identification and policies for access control (to contents and to functionalities) need to be managed wisely in a comprehensive approach, because of interoperability, security and UI usability issues	[Access Control, Learners Evaluation]	Functional

Table 4.3: Requirements regarding to Collaborative Business Process and Knowledge Based Learning

4.2.3. Business Process and Knowledge Based Learning Modelling

Id	Title	Description	Justification	Taglist	Type
11	BP-Model and Wiki Alignment after Changes	The quality of the wiki shall be assessed after changes in it by the users, modified wiki contents shall be checked against the BP models	The quality of the wiki might change after a modification. Since we foresee both (1) quality evaluation based on the feedback of the user and (2) quality evaluation based on the consistency between models and wiki pages, here we highlight the fact that the quality check after changes on a wiki page can be performed only through the second approach for quality evaluation, since the evaluation of other users might not be available right after the application of the modifications.	[Documents Quality, Evolution, Models to Documents Consistency, Quality]	Functional
24	Meta Model based Modelling Environment	The system modelling tools must support metamodelling.	This is particular interest when domain dependent aspects need to be introduced.	[Metamodel]	Functional
61	Model-Versioning	The system shall enable versioning of the model editing	We have to keep track of the changes applied to the models in order to revert changes and to identify the people who edited the models. This can be useful to support the identification of experts.	[Models Quality, Quality, Track Changes]	Functional
83	BP-Modelling Processing: RDF Export	The system must offer at least rudimentary export of process knowledge to ontology (RDF) that can be further refined by e.g. ProtÃl'ge	Based on the necessity to include different artefacts in the business process used by PA's, to integrate different modelling objects and mechanisms - a semantic technology will have to be used. As much of knowledge is available in the defined processes - it could be a useful starting or extension point to gather the concepts out of the business process models.	[Execution Environment, Modelling, Ontologies]	Functional

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Table 4.4 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
84	BP-Modelling Processing: Adaptive Import / Export	The system must have an adaptive export/import function (WS-based for easier integration)	Based on the complex environment such as PA - system should be capable of providing means of interacting with external systems -> through publishing, exporting, importing - business processes and relevant artefacts (documents) over a standardized interface. This will also be starting point for 3rd party providers to integrate with Learn PAd.	[Modelling]	Functional
109	BP-Model: Textual Description	The system shall enable learner to contribute textual contents for process specification.		[Execution Environment, Modelling]	Functional
229	BP-Model Processing: Automatic Recommendation of Process Optimization	The system should be able to analyse civil servants' feedbacks and comments and to automatically derive recommendations of possible process optimizations/improvements from such analysis. In cases where automatic recommendations are not possible, the system should be able to at least classify the comments and assign them to different categories of change requests.	This requirement goes into the direction of learning on a collective level, i.e. achieving a re-engineered / improved process model derived from community contributions. It can be assumed that when civil servants are allowed to comment on a (Wiki) representation of a process model, some of their comments will contain valuable recommendations on how to potentially improve the process. The system should be able to identify such comments and present them to a human process modeler/engineer who will decide whether and how to change the model.	[Cooperation, Learners Evaluation, Modelling, Track Changes]	Functional

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Table 4.4 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
100b	Feedback History Log	Decisions on changes e.g. changes from a reference model or pattern, shall be logged. Thus not only the actual changes can be traced but also the reasons behind a decision.	If collaboratively working on an artefact, e.g. a process model, it is important that decisions are transparent and reasonable. Assume, a conflicts results from a change. In case the reason behind the decision for change is known it can be checked whether another - not conflicting - option could meet the reason, too [7].	[Modelling, Track Changes]	Functional
249c	Collaboration Mechanisms	The system should include mechanisms for social cooperation	Letting users to contribute to community's contents in a social environment (chatting, tagging, quoting, liking, using emoticons, adding text and multimedia and so on) makes the learning process nicer and emotionally more effective	[]	Functional
29b	BP-Model Hierarchical Consistency Check	The system shall check consistency between global and local level/view and vice-versa	The goal is verifying high-level models and ensure that also low-level models that are derived from the high-level model are verified because they inherit the same structure. Some global properties (e.g., AG properties) that hold on the global model normally hold also for the derived refined model, if compliance is ensured with the parent model. Other properties (e.g., Existence properties) shall be verified also on the local model. The goal is to reduce the verification effort, and verify most of the properties on the high level view.	[Abstraction, Modelling, Models Quality, Quality]	Functional

Table 4.4: Requirements regarding to Business Process and Knowledge Based Learning Modelling

4.2.4. Business Process Learning & Knowledge Assessment

Id	Title	Description	Justification	Taglist	Type
104	Learning Dashboard	The system shall provide a dashboard for learning experience assessment to be used by management.	In order to adopt Learn PAd approach in public administration or any large organization you need to have support by top management. Thus we need to provide a simple but informative means for the management to assess the learning progress of the organization.	[Modelling, Skills profiling]	Functional
142	Integration of Assessment System	The system shall support integration of knowledge assessment system based on well defined API.		[KPI, Meta-model, Modelling]	Non-functional
161	Ranking The system should run some ranking mechanisms	The ranking mechanisms will support to the identification of experts, and it will also leverage meritocracy in the community.		[Learners Evaluation, Ranking]	Functional
191	Content Navigation - Ontology Based	The system should provide means to navigate between related learning objects/wiki pages, based on (ontological) relationships. For example, there should be learning objects for roles and responsibilities such that, when a civil servant is looking at the representation of a task, she can click on the role and find out more about it. And when looking at the role, the civil servant will find links to representations of the people who can fill the role.	Like in an encyclopedia, related content should be referenced from each learning object/wiki page. This makes it possible for the learner to explore deeper if needed.	[Content Organization, Learning Styles, Ontologies, Search Engines and Navigation,]	Functional

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Table 4.5 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
130a	KPI Logging	The system shall enable augmenting process information (e.g. a graphical process model) with values of key performance indicators retrieved from actual performance data.	It would be good to see real values for various process/task properties such as average duration, defect ratio, etc.	[KPI, Meta-model, Modelling]	DariusSilingas
159b	KPI-Models: Scorecard	The system should provide a formalism (similar to e.g. a Balanced Scorecard) to define/model organizational goals and derive learning goals from them. Afterwards, the system should be able to explain how a learning goal depends on organisational goals	Ultimately, the learning success will have to be measured by the degree to which the process execution contributes to the organisational success. Achieving a learning goal that has no connection to the organisational goals/strategy is worthless - therefore, we need to make the connection visible in order to motivate PA employees to achieve the learning goals.	[Abstraction, Learning Goals, Meta-model]	Functional
249e	Collaboration Mechanisms	The system should include mechanisms for social co-operation that are emotionally satisfying. When a user wants to get involved with the community regarding a certain content, there should be adequate ways to do so, including chat, tagging, quoting, liking, rating, linking, voting etc.)	Letting users contribute to community's contents in a social environment makes the learning process nicer and emotionally more effective	[]	Functional

Table 4.5 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
107	Learn PAd-System: Agreed Standards	The system should be based on agreed standards both order to permit data transfer and component communications.	The intention is to consider standards both for formats and integration/interaction mechanisms in order to make easier "substituability" of components. This requirements would like to foster interoperability among the different components through the usage of standards.	[Modelling]	Non-functional
143	Integration with APIs	The system shall support integration of different modelling environments based on a well defined API.		[KPI, Meta-model, Modelling]	Non-functional
220	Simulation Environment	The system must provide an execution engine for running learning session (+ simulations)	Simulations should follow a learning script that is executed by an engine. This engine must provide the mean for physically run and manage the execution and the user interaction (e.g., user inputs for deciding which simulation path to take, etc.)	[Execution Environment, Learners Evaluation]	Functional
265	Content Consistency	The system must guarantee quality and consistency of different versions of the same data.	It is important to guarantee that the current version of data is consistent with the previous ones.	[Access Control, Documents Quality, Learners Evaluation, Models to Documents Consistency]	Functional

Table 4.5: Requirements regarding to Business Process Learning & Knowledge Assessment

4.3. Learn PAd Concept - The LANGUAGE

4.3.1. Modelling language

Id	Title	Description	Justification	Taglist	Type
6	BP-Models: Content references	Documents, artefacts and data object related to the process should be referenced by business process model elements	Documents flow is particularly relevant in public administrations, in most of the case documents are the main input-output. Learning based on business process means also know what are the documents involved in the different tasks.	[Modelling]	Functional
7 a	Roles and Profile	The learning system should support different learning profiles	People that will learn based on the proposed solution could be different in term of process execution expertise, so it is important to consider that different abstraction levels of the same Business Process should be considered.	[Learning, Learning Goals, Roles and Actors, Skills profiling]	Functional
32	BP-Modelling Standards	Modelling tools and learning platform should use standards when available.	Standard are suitable to create consistency.	[Learners Evaluation, Models Quality, Models to Documents Consistency, Quality]	Functional
51	BP-Modelling Method: BPMN usage	The BP shall be defined according to specific standards The usage of standards might help in the definition of models with a uniform appearance	[Models Quality, Quality]	Functional	None (functional)
59	BP-Models: Global and Local Views	The system shall support the definition of a relationship between the global BP view and the local BP view		[Abstraction, Metamodel, Modelling, Models Quality, Quality]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
81	Custom Business Process Meta-model Extensions	The system shall support tailoring standard business process metamodel for specific needs of a particular PA office by adding custom properties for selected business process model elements.	BPMN provides a standard set of properties for process model elements. However, different organizations will have different specific needs for augmenting generic process information with additional information such as auditing logs, confidentiality levels, etc. It is impossible to foresee everything that might be needed by in different PAs. Therefore the system shall enable tailoring business process metamodel with specific extended properties, which are not part of BPMN or another standard business process modelling language. Managing information for these properties shall be supported in textual knowledge base system with minimal configuration effort.	[Execution Environment, Modelling]	Functional
105	Distinction Between Read-Only and Editable Content	The system shall enable specifying which information can be changed/modified in the textual business process knowledge base and which cannot be changed and must be kept as provided from the business process model.	Some of the knowledge information will be derived from model and should only be modified there by appropriate people to ensure proper governance and compliance. Also, it might be that specific information needs to be changed only in the model, e.g. process ID and name probably cannot be changed, while its description, links to external documents and similar information can be modified in a knowledge base.	[Cooperation, Modelling]	Functional
119	BP-Modelling Processing: Simplified Graphical Representation	The system shall use a simple graphical notation with few notation elements that can be easily learned.	The goal is to make the system easy to use for the public administration personnel.	[Abstraction, Modelling]	Non-functional
121	Business Process Model in Multiple Abstraction Levels	The system should support multiple abstraction levels of business process knowledge representation.	Managers will need higher level process models that the workers who need to perform atomic tasks.	[Abstraction, Modelling]	Functional

Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
122	Simplified Graphical Notation	The system should allow usage of e.g. Abstract notation language concept to enable adaptation of notation based on user skill level	As the stakeholders using the system will have different skill levels, a functionality is needed to enable (at least on the object level) update of the notation based on the preferences of the user.	[Abstraction]	Functional
125	BP-Models: Different views	The system must provide a way to define "views" to allow different modes of accessing one specific business process.	Based on the skills of the users or on the current task that is being performed (e.g. by a specific department) this functionality will allow confrontation only with a specific tasks or parts of available objects within the meta model	[Abstraction, Modelling, Traceability]	Functional
127	Meta Model Evolution	The system shall support evolution of the meta-models	We may start using a specific modelling language, but based on the feedback from the requirements phase (1-phase) or during the trials/pilots (2-phase) - there has to exist a functionality to adapt the meta model (adding or removing functionality)	[Metamodel, Modelling, Models Quality]	Functional
129	Content Document Modelling	The meta model used by the PA's must have a way of providing direct pointers to relevant documents.	Based on the nature of the UNICAM use case - it is utmost important to be able to define these pointers within the process.	[Documents Quality, Execution Environment, Modelling]	Functional
131	BP-Modelling Processing: Performance monitoring	The modelling language (and corresponding platform components) should allow some sort of performance monitoring model to track/monitor the success.	It is important to define KPI's that should be monitored. This can be achieved on the ML level by providing applicable model types and mechanisms to monitor and evaluate the current state of the system. A viable approach would be to adopt the BSC.	[KPI, Metamodel, Modelling]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
133	Learning Experience Profiling	The system should be able to profile learning experience The possibility to profile the knowledge of a civil servant permits to better organize its learning experience, providing and suggesting contents that are actually interesting for the learner	[Learning, Metamodel, Modelling]	Functional	None (functional)
135	BP-Modelling in Graphical Notation	Business process model should be specified using graphical notation.	Graphical representations are better to comprehend, as epitomized by the widely-used proverb, "a picture is worth a thousand words". An analysis of research on the topic is provided by [23].	[Metamodel, Modelling, Models Quality]	Functional
136	Learn PAd Meta Model: formalization	All meta-models, and hence models, should be formally described in an ontology in order to reason on models and changes, for example to detect modelling anomalies and inconsistency, to support identifying inconsistency in changes.	Besides the common view on ontologies as an explicit specification of a shared conceptualization [6], [25] it allows for automatic reasoning and hence, for modelling support and change analysis.	[Metamodel, Modelling, Ontologies]	Functional
137	Learning Goals for Process Model	The system should support the definition of learning needs for processes	If a BP model explicitly relates to its learning goals the learning experience of the civil servant can be better customized	[Learning, Metamodel, Modelling]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
141	Business Process Model Integration with Business Rules and Motivation, Data and Roles	The system shall enable integrated modelling of roles (who), process (how), information items / documents (what), and business rules (how/why) and business motivations.	Most public administration processes use documents and business rules, and roles are important as well. In order to build comprehensive models the possibility should be provided to create models comprising elements of all relevant models, e.g. BPM elemtns + Business Motivation elements + learning goals etc. However, it should be possible to view such comprehensive models but also hiding elements e.g. based on user-models or user-selection and viewing simplified models.	[Abstraction, Metamodel, Modelling, Roles and Actors]	Functional
144	Learners Knowledge Assessment	The system shall enable assessing learners' knowledge based on questionnaires that are derived from model-based and text-based knowledge about business processes.	DoW states that Learn PAd will provide knowledge assessment functionality.	[Learning, Modelling]	Functional
145	Questionnaires for Knowledge Assessment	The system shall provide a way to formulate tests and questions for assessing learners' knowledge.	There should be a way to assess how well the learners understand the processes presented in knowledge base. Therefore it is necessary to enable specification of questions that are traced to specific process knowledge items and formulating questionnaires using these questions that can be used for assessing knowledge of learners.		Functional
151	Model Re-use	The system shall enable (re)use of model-defined items (business terms, role names, process task names, etc.) in text-based contents.	It is difficult to keep textual contents consistent if we do not reuse model-based items.	[Documents Quality, Modelling, Models to Documents Consistency]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
168	Track Changes: Models	The system shall visualize the differences between knowledge item versions	In order to better track changes to system managed artefacts it is good to show users what changed exactly. This will allow the user to better understand what is the history of the artefact and also what are the reason why certain changes have been applied.	[Learners Evaluation, Track Changes]	Functional
178	KPI-Models: Subjective and objective	The KPI sub-system should support both subjective and objective metrics	Objective metrics are useful in expressing KPI that represent the actual status of the system, a learning process, a contributor, or a learner. While, subjective metrics are more useful when the goal is to evaluate how they are perceived by the others.	[KPI, Learners Evaluation]	Functional
179	KPI-Models: Quality Metrics	The system must allow to define KPIs and how they are calculated.	A KPI is usually defined by a metric that has a value and is calculated by a more or less complex business logic. The system must thus allow the user (in an authorized role) to define both the name and the type of the KPI, but also the actual business logic that is able to compute it. In fact, available and interesting KPI may vary over time and between different administrations. The system must allow to tailor Learn PAd KPI to the requirements of the users that will use it. An extensible mechanism for introducing KPI will make Learn PAd more attractive.	[KPI, Learners Evaluation]	Functional
257	BP-Modelling Method: BPMN and CMMN	It must be possible to model both structured processes (e.g. with BPMN) and non-structured processes/cases (e.g. CMMN)		[Content Organization, Metamodel, Modelling]	Functional

Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
108a	BP and Content Integration	The system must permit to relate BP specifications with related contents and documents	This requirements is an high-level requirements which would like to stress the fact that it should be possible to access to contents and documents from the specification of the BP	[Modelling, Traceability]	Functional
118a	Content Role Based Views	The system should provide the possibility to switch views for specific viewpoints. For example an expert business user might be interested on other aspects or different level of granularity than a novice user.	Providing personalized, or role-based, views on content could reduce complexity and enhance user friendliness.	[Abstraction, Modelling, Roles and Actors]	Functional
139a	BP-Modelling Combining Structured and Unstructured Processes	The system shall support modelling both structured business process (e.g. in BPMN) and unstructured business process (e.g. in CMMN) and integrate them together	The Case Management Model and Notation (CMMN) specification expands the boundaries of what can be accomplished with BPMN by incorporating knowledge worker driven adaptive work. Now customers can address a much broader spectrum of processes using a combination of BPMN and CMMN, said Ralf Mueller, Architect at Oracle and co-chair of the CMMN Finalization Task Force. The Case Management Model and Notation (CMMN) is available at the OMG web-Site: http://www.omg.org/spec/CMMN/1.0/Beta1/	[Metamodel, Modelling]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
159a	KPI-Models: Scorecard	The system should provide a formalism (similar to e.g. a Balanced Scorecard) to define/model organizational goals and derive learning goals from them. Afterwards, the system should be able to explain how a learning goal depends on organisational goals	Ultimately, the learning success will have to be measured by the degree to which the process execution contributes to the organisational success. Achieving a learning goal that has no connection to the organisational goals/strategy is worthless - therefore, we need to make the connection visible in order to motivate PA employees to achieve the learning goals.	[Abstraction, Learning Goals, Meta-model]	Functional
175a	Roles and Profile	The system should be able to model profiles for potential customer of the specific PA.	Having a profile of the final user that will refer to the BP, could help learners in having a better comprehension about the overall process the BP models	[Learners Evaluation, Roles and Actors]	Functional
187a	Content - Semantic Search	The system shall guide users to relevant contents using semantic features (a search engine) to find appropriate contents	As learning experience is modelled in a sort of workflow, it should be useful for learners to jump directly to certain end or middle points of the BP, not considering the whole path	[Learners Evaluation, Search Engines and Navigation]	Functional
192a	Learner Profiles	The system shall deal with different type of learners (PA, SME, etc, ...)	it is necessary to adapt the learning approach to each single group of target, because learning by doing is something that must fit with different kind of organizations and because each group of target has a different point of view of the same process	[Learners Evaluation, Learning Styles]	Functional
203 a	Information Access Authorization Based on Roles and Permissions	The system must protect the access to information so that only authorized users can access to a given set of data for reading or editing	This is related to roles in the public administration. Civil servants that are learning might be evaluated by their managers, so only managers must be able to access data related to what the civil servants are doing (e.g., results of the assessments of their acquired knowledge) It should not be possible, for example, for a civil servant to look at the results of his colleague	[Access Control, Learners Evaluation]	Functional

Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
207 b	Content Types	The system shall support different types of contents (video, text, etc.) and access to external services (e.g. chat)	The system must be able to offer the needed explanation about a learning process or step using visual or audio content. A learner must be able to access to means for having assistance during the learning process, these can be an access to a conf call connection, a mailer, an enterprise network, etc.	[Content Organization, Learners Evaluation]	Functional
216a	Learning Categories	The system should support categories of learning sessions (i.e. optional/mandatory/recommended)	Such categorization could help learners in organize their tasks	[Execution Environment, Learners Evaluation]	Functional
243a	KPI-Model: Learning Assessment	The system must support KPI for assessing learners and learning processes.	Key Performance Indicators represent an efficient means for evaluating applications, services, and even learners. In each case we may state a list of threshold values that represent the desired values. After monitoring the enacted processes and the learners behaviour the system and more precisely the governance part must be able to assign specific marks and notations.	[KPI, Learners Evaluation]	Non-functional
29a	BP-Model Hierarchical View Derivation	The system shall verify derivation of properties from higher to lower level of business processes and vice-versa	The goal is verifying high-level models and ensure that also low-level models that are derived from the high-level model are verified because they inherit the same structure. Some global properties (e.g., AG properties) that hold on the global model normally hold also for the derived refined model, if compliance is ensured with the parent model. Other properties (e.g., Existence properties) shall be verified also on the local model. The goal is to reduce the verification effort, and verify most of the properties on the high level view.	[Abstraction, Modelling, Models Quality, Quality]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
50a	KPI-Models to assess Model-Quality	Quality attributes SHALL be defined for both wiki pages and business processes	This requirement is in line with the DOW. In particular, according to the WP4 description we will have to define mechanisms for assessing the quality of both models and contents. Since they are different kinds of artefacts, it will be necessary to understand what are the quality attributes that make sense for wiki pages and those for business processes.	[Documents Quality, Models Quality, Models to Documents Consistency, Quality]	Functional
63a	Expert Roster	The system shall have the ability to suggest specific experts to specific learners	Experts can give advices to learners for a specific PA procedure, but also for understanding a model associated to a specific procedure.	[Cooperation, Learning, Skills profiling]	Functional
64b	Expert to Domain Classification	The system shall be able to classify the experts according to their contribution to the learning material (documents and BP models)	The classification of experts is useful to suggest experts to learners and to understand who can change the model of a procedure, or the wiki content of the same procedure, when change requests are issued by the community or by the regulations that are represented in the BP models and associated wiki pages.	[Learners Evaluation, Learning, Skills profiling]	Functional
77a	BP-Model: Feedback on Quality	The system shall enable users to provide feedback about the quality of the model		[Models Quality, Quality, Roles and Actors]	Functional
89a	Content Governance Based on User Permissions	The system shall support user permissions for views and editing contents.	In public administration sector it is unlikely that everyone is able to see and editing everything.	[Access Control, Cooperation, Modelling, Roles and Actors]	Functional

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Table 4.6 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
8a	BP-Model and Contents Iterative Refinement	The system shall provide the means to interactively refine models and wiki pages and keep track of the revisions by the involved agents	The definition of models and wiki pages is an iterative process. Consequently it's a mandatory requirement for the system to provide the means to refine models, keep track of the modifications done, and somehow propagate such modifications to corresponding wiki pages.	[Evolution, Modelling, Skills profiling]	Functional

Table 4.6: Requirements regarding to Modelling Language

4.3.2. Modelling technique

Id	Title	Description	Justification	Taglist	Type
70	Expert Feedback and Knowledge Harvesting	An approach shall be defined for retrieving PA information	The PA procedures shall be represented with BP models, but the procedures are normally in paper-like document formats. These documents have to be retrieved in a structured way, which implies knowing who can provide the documents, and how can the documents can be passed to the people who are in charge of modelling.	[Modelling, Project]	Functional
90	Expert Feedback and Knowledge Harvesting	The system should allow easy integration of knowledge from domain experts.	As extremely valuable - the domain experts knowledge should be retrieved and applied in the Learn PAd system whenever possible. To do this domain experts should be allowed to use tools they are comfortable with and Learn PAd system should provide necessary mechanisms to semi-formalise this knowledge to graphical models.	[Cooperation, Modelling]	Non-functional
90	Expert Feedback and Knowledge Harvesting	The system should allow easy integration of knowledge from domain experts.	As extremely valuable - the domain experts knowledge should be retrieved and applied in the Learn PAd system whenever possible. To do this domain experts should be allowed to use tools they are comfortable with and Learn PAd system should provide necessary mechanisms to semi-formalise this knowledge to graphical models.	[Cooperation, Modelling]	Non-functional
124	Business Process Models in Multiple Levels of Detail	The system should support multiple levels of detail for a business process and an easy navigation between levels of detail.	It is a common practice to represent complex business processes in several levels of detail in order to deal properly with the complexity. Public administration processes will typically be rather complex and having just a single level of details will be not be a suitable solution.	[Abstraction, Content Organization, Modelling, Traceability]	Functional

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Table 4.7 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
128	Roles and Expert Levels	The modelling language/method must allow the definition of user skills	It is important to have a vehicle where we will define the skill profiles of the users of the system as this is relevant to decide on how to provide them with content (type), how to adapt the delivery channels, etc.	[Abstraction, Metamodel, Modelling]	Functional None (functional)
100a	Change Reasons Log	Decisions on changes e.g. changes from a reference model or pattern, shall be logged. Thus not only the actual changes can be traced but also the reasons behind a decision.	If collaboratively working on an artefact, e.g. a process model, it is important that decisions are transparent and reasonable. Assume, a conflicts results from a change. In case the reason behind the decision for change is known it can be checked whether another - not conflicting - option could meet the reason, too [7].	[Modelling, Track Changes]	Functional
249b	Collaboration Mechanisms	The system shall include mechanisms for social cooperation	Letting users to contribute to community's contents in a social environment (chatting, tagging, quoting, liking, using emoticons, adding text and multimedia and so on) makes the learning process nicer and emotionally more effective	[]	Functional

Table 4.7: Requirements regarding to Modelling Technique

4.3.3. Model processing

Id	Title	Description	Justification	Taglist	Type
10	BP-Modelling Processing: Automated Validation Check	The system shall check the properties of a BP model for consistency, quality, and completeness where possible.	The goal of this requirements is providing a smart way to verify the models: if a model has already been verified, and it evolves into another form, techniques shall be devised to provide validation only for the part that has been modified. This has an impact on the modelling guidelines: the more a model is modular, the easier it is to verify only parts of it, while ensuring the correctness of the other parts.	[Evolution, Models Quality, Quality]	Functional
92	BP-Modelling Processing: Readiness for Execution	The meta model applied to design the business processes should allow simulation to test it and to foster learning.	Modelling objects should be extended with specific attributes to support simulation in internal/external (from Learn PAd point of view) simulation tools.	[Execution Environment, Metamodel, Modelling]	Functional
97	Content Pattern Mining	The system SHOULD support the automatic discovery of patterns from already existing contents	This requirement suggest to include mechanisms to support the automatic detection of best practices, recurrent "behaviours",	[Modelling]	Functional
98	Process Pattern Mining	It should be possible to mine for and identify patterns in business processes of the same domain, e.g. application for move, but created by different public administrations.	If congruities and differences can be mined and common patterns identified 'best practices' models (or at least patterns/process parts) can be created and provided for further use, e.g. by other public administrations as basis for their specific models or in inter-organisational processes (that have no 'owner')	[Modelling, Models Quality]	Functional
126	BP-Model Navigation	The system should enable easy navigation between higher and lower level process models	This requirements intends to improve readability of models permitting to hide details when necessary	[Abstraction, Modelling, Traceability]	Functional
150	BP-Models: Role Projection	The system should derive process skeletons for role view	It can be useful to have the possibility to derive projections the different roles participating to a complex/multi-party BP	[Abstraction, Modelling]	Functional

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Table 4.8 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
167	BP-Modelling Processing: Track Changes	The system must be able to track changes to the models/-content.	Should allow the modellers and content producers to understand how things evolved over time.	[Learners Evaluation, Track Changes]	Functional
184	BP-Modelling Processing: Critical Path Specification	The system must enable specifying the most critical paths in the BP	The different path included within a BP instantiation will have different level of difficulty wrt their comprehension. Both the automatic generation procedure, and the simulation process must be aware of such an aspect.	[Learners Evaluation, Questionnaires]	Functional

Table 4.8: Requirements regarding to Model Processing

4.4. The Learn PAd Usage - USER SCENARIO

Id	Title	Description	Justification	Taglist	Type
3	Learners Motivation The System should send motivational/stimulation messages to the users in order to invite them to use the system for learning and/or to improve score and level, e.g. when the last contact with the system was long ago.	The PA are usually composed of person that are afraid of novelty, demotivated by bureaucracy and not favourably disposed/friendly with the technology innovation	[Access Control, Learners Evaluation]	Functional	None (functional)
4	KPI-Models: Guidelines	The Learn PAd project shall define a set of guidelines for writing quality models	Guidelines for writing models are needed to improve the quality of the models.	[Modelling, Models Quality, Project, Quality]	Non-functional
19	BP-Wiki and BP-Model alignment Content producers shall check the ambiguity of the NL description of the BP model to be inserted in the wiki	We foresee an automated ambiguity check to enable the production of quality content. This requirements suggest the usage of a human-based ambiguity check, in order to improve the automated ambiguity check capabilities. This enable a collective contribution to the quality checks of the Wiki documents.	[Documents Quality, Models to Documents Consistency, Quality, Roles and Actors]	Functional	None (functional)

Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
38	BP-Wiki and BP-Model alignment	The derived models (from wiki) shall be analysed against the BP model	The goal is to ensure consistency between wiki pages and BP models, in order to produce quality content.	[Documents Quality, Models to Documents Consistency, Quality]	Functional
48	KPI-Models: Quality Metrics	The system SHALL have a repository of quality attributes with corresponding metrics or heuristics	A way to assess the quality of wiki pages and models consists of adopting quality attributes that might be defined in terms of metrics and heuristics amenable to be evaluated. In order to enable the reuse of such quality attributes for different projects/models/contents, it is necessary to have a repository of them.	[Documents Quality, Models Quality, Models to Documents Consistency, Project, Quality]	Functional
49	KPI-Models	The system SHALL enable the system administrator to add quality attributes and corresponding metrics or heuristics at any time, i.e. the set of quality metrics (for process models, process executions, contents etc.) should be easily extensible.	The definition of quality attributes that make sense for assessing the quality of models and contents in LearnPad is an iterative process. Consequently it is necessary to give the possibility to add/modify quality attributes and also specify the means to measure them.	[Access Control, Documents Quality, Models Quality, Models to Documents Consistency, Quality, Roles and Actors]	Functional
57	Help and Assistance	The system shall provide a helpdesk to let the learners contact the Experts of a specific BP, i.e. when a civil servant gets stuck in a certain (activity of a) BP instance, the system should be able to put her in contact with experts for that activity/BP.	Some knowledge is not codified, some is even hard or impossible to codify. Especially for very rare and exceptional cases, it can be much faster and more efficient to transmit knowledge via personal communication with an expert instead of codification.	[Learning, Roles and Actors, Skills profiling]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
60	Modelling Methodology	The process of the system usage shall include a step where a PA procedure is translated into a model	Normally, the PA procedures are not in a BP model format. In order to produce consistent models from PA procedures, we expect to define a structured approach to pass from PA procedures to models [Modelling, Project]	Functional	None (functional)
78	KPI-Model Language Quality	The system shall provide language quality metrics for Wiki documents that are independent from the language	The wiki pages will be edited in a language that is specific for the country where the system is used. However, some known metrics on the quality of the language are independent from the language. If we identify these metrics, we can have some basic quality checks that can be employed in any version of the system, regardless of the country in which it is used.	[Documents Quality, Quality]	Functional
88	Content Rating	The system must provide rating mechanisms of contents	In order to support the evaluation of the goodness of the contents, the system should allow users to rate BP tasks, processes, etc. Very bad ratings of a certain element will trigger inspection and possible improvement of that element.	[Documents Quality, Modelling, Models Quality]	Functional
91	Roles and Responsibilities	The system must support the association of roles and admitted actions both on models and contents	In order to differentiate users, their roles and to better organize the collaboration, the system should permit to define who can do what both on models and contents.	[Cooperation, Modelling, Roles and Actors]	Functional
117	Different Roles and Profiles	The system shall support multiple viewpoints (learner, controller, manager) that provide information from perspective of a particular role.	It is important that the knowledge base provide different views so that each role finds it natural and easy to access information that is needed for them.	[Abstraction, Modelling]	Functional
148	Model Re-use of Reference Processes	The system shall enable illustrating business process with reference examples.	Nothing teaches better than a concrete example.Also, concrete examples could be essential items for knowledge assessment based on interpreting given situation (example).	[Modelling, Models to Documents Consistency]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
155	Modelling Methodology	The system should support a specific modelling procedure for KPI, business processes etc., and guide modellers along that procedure.	In order to better structure and steer the modelling, we should provide the stakeholders with guidelines on how to apply the modelling language.	[KPI, Modelling]	Functional
176	Model Re-use KPI	The system should be able to measure the degree of reuse of knowledge in real process executions.	It will be an overall important KPI to measure to what extent the knowledge offered by the system is used by civil servants. This KPI targets the learning while doing: we must make sure that we can capture how effective the Learn PAd system is in supporting the actual work of civil servants by providing the right knowledge when it is needed.	[KPI, Learners Evaluation, Traceability]	Functional
177	KPI-Models: Guidelines	The organisation must make sure that each measurement/KPI is related to at least one learning or organisational goal and that each organisational goal is measured by at least one KPI.	Similar to Req 159, this requirement should ensure that we know why something is measured, i.e. KPIs should not be introduced just for the fun of measuring, but must be related to concrete goals, either organisational goals or learning goals.	[KPI, Learners Evaluation, Learning Goals]	Non-technical

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
183	Adaptive Tests	When a user wants to test her knowledge about a specific context within a certain BP, the system should be able to provide a dynamically generated test (questionnaire) for that context. Example: a civil servant wants to test her knowledge about the activity "Check application details", but only for a certain sub-type of applications. In such case, the system should deliver a tailored questionnaire containing e.g. questions about decision criteria that apply specifically to the chosen application sub-type.	Tests must be precise and appropriate for the specific context that the BP instantiation defines.	[Learners Evaluation, Questionnaires]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
183	Adaptive Tests	When a user wants to test her knowledge about a specific context within a certain BP, the system should be able to provide a dynamically generated test (questionnaire) for that context. Example: a civil servant wants to test her knowledge about the activity "Check application details", but only for a certain sub-type of applications. In such case, the system should deliver a tailored questionnaire containing e.g. questions about decision criteria that apply specifically to the chosen application sub-type.	Tests must be precise and appropriate for the specific context that the BP instantiation defines.	[Learners Evaluation, Questionnaires]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
183	Adaptive Tests	When a user wants to test her knowledge about a specific context within a certain BP, the system should be able to provide a dynamically generated test (questionnaire) for that context. Example: a civil servant wants to test her knowledge about the activity "Check application details", but only for a certain sub-type of applications. In such case, the system should deliver a tailored questionnaire containing e.g. questions about decision criteria that apply specifically to the chosen application sub-type.	Tests must be precise and appropriate for the specific context that the BP instantiation defines.	[Learners Evaluation, Questionnaires]	Functional
186	Separation of Concern based on Ontology	The system should ensure that civil servants can assign their contributions to specific ontological entities that can be involved in modelling a business process (e.g. roles, activities, gateways, persons,) and that appear within a learning object (e.g. within a Wiki page).	This requirement, like REQ_185, is a prerequisite for capturing and organising the contributions of civil servants: civil servants should be able to contribute knowledge in a way that makes it very clear to which entities (e.g. a specific resource or a specific role) their contribution refers. This will make it easy for the system to understand what the contribution refers to.	[Content Organization, Cooperation, Modelling, Ontologies,]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
190	Learners Encrypt Point-Navigation	The system should allow learners to see the relationship of particular instances to the big picture of the whole business process (e.g. through a visual representation of the process and through highlighting the relationship within that representation). The system should offer the possibility to navigate upwards, i.e. to a higher abstraction level as provided by the big picture.	The assumption behind this requirement is that civil servants will learn more effectively when they are supported in keeping an overview of how the current learning content relates to the overall process that they are executing. Example: a civil servant receives an inquiry (e.g. by a newly registered company, see Marche region use case) about a particular, rarely used form. When accessing the wiki page corresponding to this form, the civil servant will more easily gain an overview of the purpose of this form if the relationship between the form and the relevant activity in the business process is made explicit.	[Abstraction, Content Organization, Learning Styles, Search Engines and Navigation]	Functional
200	Learners Results Access	The system should grant to professors/coaches/managers the access to the testing results and aggregations of execution logs of their related learners	Learners and also some individual learning sessions need a coach/professor/manager who is in charge of monitoring and supervising the learning process. For this, the coaches need access to summaries of the log data of that learning process.	Functional Functional	None (functional)
206	Content Structure	The system must allow content producers to organize learning material in processes (bundles of contents that are logically related)	Since al lot of contents will be produced when the system will be put in production, the system must provide users (in the right role) to organize this content in a structured way so that it's easier to retrieve for future usages. One criteria would be that of organizing learning material in courses for addressing a learning experience in a particular aspect of the public administration.	[Content Organization, Learners Evaluation]	Functional

Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
206	Content Structure	The system must allow content producers to organize learning material in processes (bundles of contents that are logically related)	Since al lot of contents will be produced when the system will be put in production, the system must provide users (in the right role) to organize this content in a structured way so that it's easier to retrieve for future usages. One criteria would be that of organizing learning material in courses for addressing a learning experience in a particular aspect of the public administration.	[Content Organization, Learners Evaluation, WP3]	Functional
233	Ranking of Answers	When a user asks a question about an activity or other characteristic of a BP, the system must have a mechanism for rating the answers provided by other users.	We assume that civil servants can leave a question about a certain aspect of a BP within the Learn PAd system and that other users have the possibility to contribute answers in the system. The answers should be evaluated by the community, like in forums for community-based question answering on the web, such as stackoverflow.com	[Cooperation, Learners Evaluation]	Functional
237	Learners Community: Invitations	The system should proactively invite civil servants to attend learning sessions in cases where learning goals in their profiles have not yet been achieved and a learning session has not taken place for a long while.	Sending remainders could be effective in the accomplishment of learners' duties but also in stimulating their learning process.	[Cooperation, Learners Evaluation]	Functional
246	Questionnaires Generation	The system should adapt questionnaires so that they focus on the really critical / not commonly understood aspects of a BP. Questionnaires should help to transmit new knowledge about BPs.	Questionnaires that cover well-known aspects are not useful. One possibility to detect criticality of aspects is to generate random questionnaires, propose to the users and gather/manage all the answers in order to identify the ones where most civil servants commit errors.	[Learners Evaluation]	Functional

Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
266	Content Moderator	The system should moderate contents that disagree with common knowledge, i.e. there should be the possibility to appoint a moderator who has the right to delete "incorrect" user contributions and/or merge duplicate contributions.	In a collaborative learning platform in which each civil servant can provide contents, what should be useful is to to moderate contents that totally disagree with previous and common knowledge. This could help to avoid malicious changes of contents.	[Access Control, Documents Quality, Learners Evaluation, Models to Documents Consistency]	Functional
163 b	Learners Motivation	The organisation or the system should provide incentives and/or a reward system to motivate civil servants to contribute and share knowledge.	Contributing knowledge costs time and its benefits are not immediately visible to civil servants. When they work with the system, their goal is to complete a certain case - contributing knowledge keeps them away from this short-term goal. Therefore, they must see or remember some benefit. The incentive might just consist in making them aware of how they benefited from others' shared knowledge. Or it can be some real reward...	[Cooperation, Learners Evaluation]	Non-functional
202d	Moderation of collaborative content modifications	The system must include mechanisms to moderate content modifications made by civil servant	In order to avoid that modifications collaboratively made by civil servant could corrupt the contents, the system must include a mechanism permitting to the responsible of a BP to moderate provided contents. Having the wiki pages open for public editing is a good thing because anyone can add material and correct errors. To guarantee the quality of the wiki pages, some individual pages could also be subject to technical restrictions on who is permitted to modify them (e.g.: only administrators, only subject experts, etc).	[Access Control, Learners Evaluation]	Functional

Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
202e	Civil servant reputation	The system should include reputation mechanisms for the civil servant collaborating in the definition of contents	Reputation mechanisms will permit the emergence and identification of experts for a given process. The reputation mechanism should be based both on the quantity of contents provided by the civil servant and on the quality of it derived by feedback on contents given by colleagues. Indeed if the system has the ability to profile the users based on the items they interact with (the wiki pages, for example), it would be possible to create a list of experts in a given subject. Such list could be useful for identifying BP experts to be assigned for the review of the newly added/updated wiki pages.	[Access Control, Learners Evaluation]	Functional
209a	Learning through Simulation	The system must be able to simulate the behaviour of some participant in the BP	During the training a learner may need to interact with some other participant of the BP. The simulation environment must provide some features so that the learner can practice in a realistic environment. Thus it must support the synthesis and the engagement of mocks, where each of them (even partially) conforms with the behaviour of a real participant.	[Execution Environment, Learners Evaluation]	Functional
223a	Learners Gathering	The system should support the gathering of learners in simulations. When a user who is running a simulation requests it, the system should search for civil servants of a given role who are on-line and could participate in the user's running simulation.	During the training a learner may need to interact with some other participant of the BP. The simulation environment must provide some feature aiming to gather learners that would like to actively play different roles within the same simulation session. In this sense, the simulation system creates the conditions for letting learners practice among them.	[Execution Environment, Learners Evaluation]	Functional

Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
243c	KPI-Model: Learning Assessment	The system must support defining and measuring KPIs for assessing learners and learning processes.	Key Performance Indicators represent an efficient means for evaluating applications, services, and even learners. In each case we may state a list of threshold values that represent the desired values. After monitoring the enacted processes and the learners behaviour the system and more precisely the governance part must be able to assign specific marks and notations.	[KPI, Learners Evaluation]	Non-functional
245d	Learning Process Monitoring The system must evaluate thanks to a processor if the learners are well following the learning process.	Following the actions produced by the learners while doing the learning process enables the system to draw the users behaviour in several conditions.	The Learn PAd system must be able to observe the process and to evaluate at the end (or at runtime) if the correct process is being achieved or not. KPI can be exploited to that end.	[Learners Evaluation, Ranking]	Functional
73a	KPI-Model Quality	We shall define quality attributes for the model and for the process that is modelled	When one gives a quality judgement to a model, he might be judging the process - which might be hard to implement and understand - or the model of the process - which might be poorly represented. We have to identify a way to distinguish among these judgements that come from the learners. For example, a distinction among model rate and process rate (i.e., the system allows users to express different categories of rates) can be useful.	[Models Quality, Project, Quality]	Functional

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Table 4.9 – *Continued from previous page*

Id	Title	Description	Justification	Taglist	Type
77c	BP-Model: Feedback on Quality	The system shall enable users to judge the user quality of the model (in its entirety, but also specific parts of the model), i.e. a user must be able to give feedback about any problems that might arise when trying to follow the process.	Trying to follow a badly modelled process is annoying. It is useful if the system allows to assign feedback directly to the BP part that is affected by the criticism.	[Models Quality, Quality, Roles and Actors]	Functional

Table 4.9: Requirements regarding to Usage Scenarios

5 Goal Models

Goal modelling [28, 21, 27] is a requirements modelling and analysis technique that is useful to (a) provide a hierarchy to the requirements, (b) evaluate conflicts and obstacles among requirements and (c) to increase requirements completeness. It is adopted within the context of the Learn PAd project in order to support the requirements analysis phase. Within this context, we have adopted the KAOS goal modelling technology.

In **KAOS** [28], a *goal* can be regarded as a system, high-level requirement. A goal is a need that can be satisfied with the collaboration of different system agents. Therefore, a goal might involve the hardware, the software, the different actors, the communication system, etc. In the hierarchical tree-like representation (i.e., the goal models reported in the next sections), goals are blue inner nodes and red clouds with natural language text that specifies the goal. Blue inner nodes represent *hard-goals*, which means goals that can be satisfied in a clear-cut sense. Red clouds represent *soft-goals*, which means goals that cannot be satisfied in a clear-cut sense. These latter can be regarded as high-level non-functional requirements, and are normally not part of the hierarchical tree that is the core of the goal model.

On the other hand, a *requirement* can be regarded as a software requirement. A requirement is under the responsibility of a single agent of the software-to-be. In the hierarchical representation, a requirement is represented as a blue leaf in the goal model tree.

Finally, an *expectation* is a goal under the responsibility of a single agent in the environment (people, hardware, communications). Therefore, the goals are refined into requirements and expectations. In the hierarchical representation, an expectation is represented as a yellow leaf in the goal model tree.

Goals are decomposed into sub-goals that can have an AND relationship (i.e., both sub-goals have to be satisfied to satisfy the main goal) or an OR relationship (i.e., it is sufficient to satisfy one of the sub-goals to satisfy the main goal). AND decomposition of goals is represented with squared links, while OR decomposition of goals is represented with direct straight links.

A goal model includes goal, requirements and expectations and provides a hierarchical view of the needs of a system. To provide such a view in the context of the Learn PAd project, we have followed a manual process that can be summarized as follows:

1) **Requirements Gathering:** requirements have been gathered through the KJ method and the collaborative approach outlined in the previous chapters;

2) **Requirements Justification Analysis:** for each requirement, a justification has been provided. The justification basically defines the goal for the requirement, so it can be employed as a higher-level goal in the hierarchical goal model representation;

3) **Goal Grouping:** according to the justification provided, goals are grouped and the hierarchy is further refined to get a complete goal model for the considered requirements.

The process outlined above has been performed incrementally for the three sets of requirements produced by the three groups involved in the elicitation phase. First, the requirements produced by the quality group have been considered. Then, the requirements produced by the modelling group have been considered. Finally requirements of the simulation group have been evaluated.

At this stage, goal modelling serves as a tool to have a hierarchical and high-level view of the needs of the platform, since it enables reasoning on the main organizational goals that shall be addressed by the different Learn PAd components and actors. Moreover, it will be used to provide a preliminary and informal completeness analysis on the currently elicited requirements (Section 5.8).

The conflict and obstacles analysis [28], which will help issuing further requirements and evaluating the completeness of the overall requirements set, has been postponed to the moment when the requirements set will be considered enough detailed for the purposes of the platform.

In the following, we describe the goal models that we have defined at this stage. It is worth noting that all the goals are reported in passive form, since this is the typical convention in KAOS. However, in the presentation of the goals, we will rephrase the goals in active form, for the sake of readability.

5.1. Main goal model

The main goal model is reported in Fig. 5.1. Light blue and dark blue boxes include hard goals, while red clouds represent soft-goals. Moreover, each dark-blue box is associated to a refined goal model that is detailed in the other figures presented in the next sub-sections.

The overall goal of the project is to improve the quality of service of the public administration (PA), by addressing the quick changes in the procedures of the PA. To this end, during the requirements analysis, we have identified four main goals (with proper sub-goals) to address:

1) **Provide process-driven learning:** the overall idea of Learn PAd is to use the Business Process Modelling Notation (BPMN) to teach civil servants how the procedures shall be implemented in practice, and to complement the models expressed according to the BPMN with WIKI documents that give details in natural language about the procedures. To address this goal, two sub-goals have been identified:

    1) **Provide informative learning:** informative learning implies the definition of the learning content (BP Models, WIKI documents and comments) (**Learning content defined**, see Section 5.2) and the access of the learners (i.e., the civil servants) to such content (**Learning content accessed by learners**, see Section 5.3). The content is expected to be defined off-line by designated process experts who translate the procedures into BP models and provide the first versions of the WIKI documents associated to the models (**Basic definition of learning content provided**). Moreover, the content is expected to be incrementally enriched by the civil servants during the learning activities and by the designated process experts (**Iterative definition of learning content provided**). The former will contribute to the enrichment of the WIKI documents. The latter will contribute to the enrichment of the BP models. Both will contribute to the amelioration of the learning content with *comments* to models and WIKI documents. The contributions of these subjects to the learning content is oriented to increase such content, but also to share the knowledge and to foster cooperation within the PA organization and among different PA organizations.

    2) **Provide procedural learning:** procedural learning implies the usage of an interactive simulation engine to let the civil servants practice with the PA procedures represented as BP models.

2) **Ensure the quality of the learning content:** the provided learning content is expected to present specific quality attributes. In particular, BP models have to be checked against structural quality attributes and behavioural quality attributes, while WIKI documents have to be checked for their linguistic quality.

3) **Perform knowledge assessment:** the system shall enable the assessment of the learners to verify that the learning content has been properly acquired. This will promote meritocracy, which
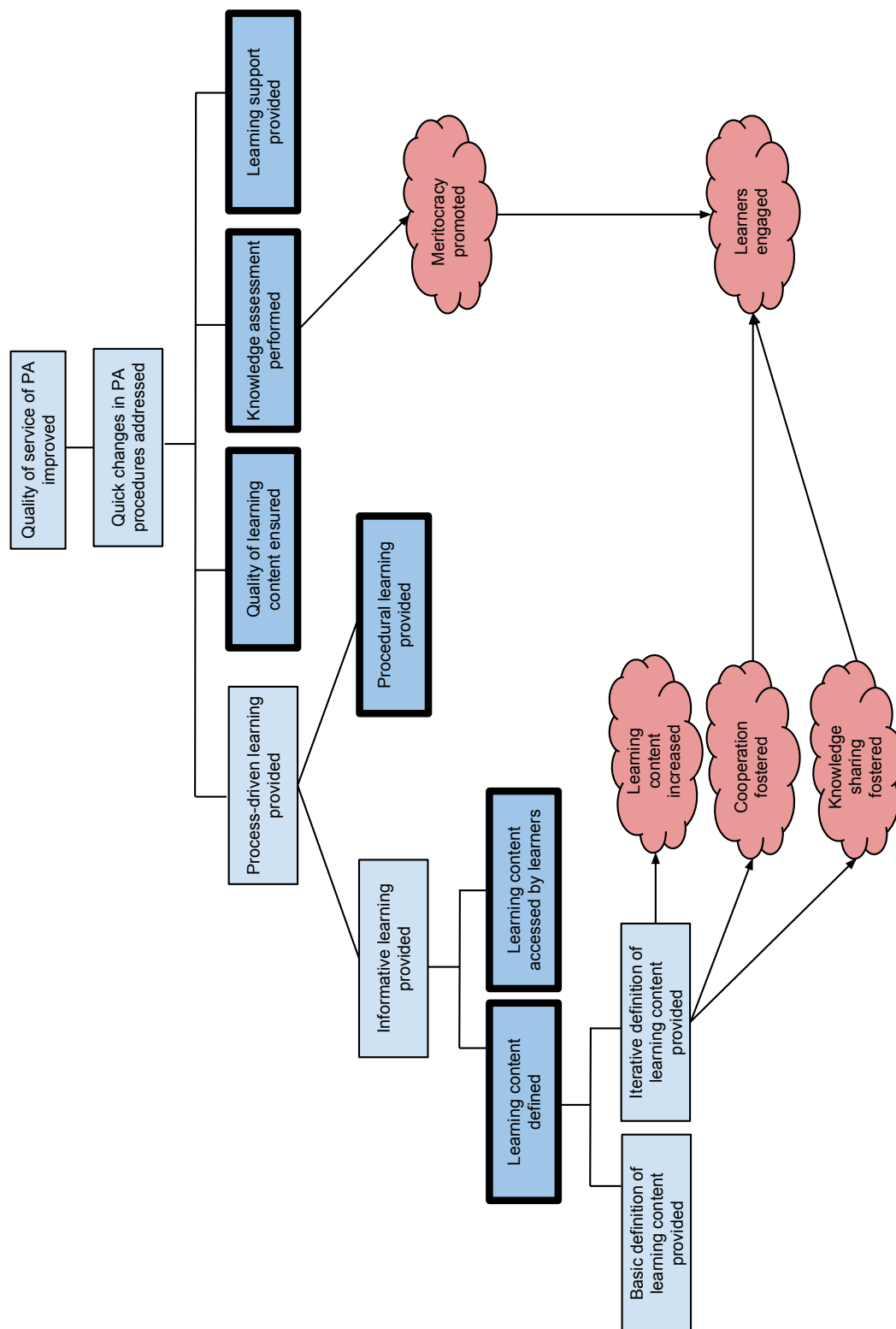
Figure 5.1: Main Goal Model for the Learn PAd Project

will keep the learners engaged together with the previously defined means to foster cooperation and knowledge sharing.

4) **Provide learning support:** the system shall provide proper support for the learners, by involving experts who can give advice and suggestions during the learning process.

5.2. Learning content defined

Fig. 5.2 outlines the high-level goals associated to the definition of the learning content. Since the goals are rather clear, we do not describe each goal in detail. Instead, we wish to give a high-level description of the presented model. Concerning the notation, we recall that yellow boxes identify *expectations*, which, in the Learn PAd context, are goals that have to be addressed by human actors involved in the project. This notation is adopted also in the other goal models.

The definition of the learning content is expected to be performed according to two main steps: a basic definition and a subsequent iterative and incremental definition. The first step leads to the production of BP models and associated WIKI documents. In the second step, both BP models and WIKI documents are enriched by the community. The former are expected to be updated by process experts, while the latter are expected to be updated by the civil servants according to their experience in implementing the procedures in practice. Moreover, the learning content can be augmented also with **comments** to BP models and WIKI documents. In the following, the term "learning content" identifies BP models, WIKI documents and comments.

A relevant need that has been raised and that occurs also in the other goal models is the need to provide a **profiling** approach, which, in this case, enables the identification of the skills of the civil servants who contribute to the learning content.

5.3. Learning content accessed by learners

Fig. 5.3 outlines the high-level goals associated to the access to the learning content. To enable access to the learning content, means are required to (a) **store** the content using semantic-based index (ontology) or a term based index; (b) **search** the content either with the support of TAGS – which can be defined by the community of learners or statically defined at the stage of platform deployment – or by means of natural language (NL) queries; (c) **navigate** the content, which include BP models, WIKI documents and comments, by means of different navigation paradigms; (d) **recommend** the content to the learners based on their skills and based on their needs.

5.4. Procedural learning provided

Fig. 5.4 outlines the high-level goals associated to procedural learning. To address this goal, two methods are foreseen, namely procedure simulation, and monitoring of the procedure during its day-by-day application.

To support simulation and ensure effective learning, we need to provide realistic simulation mocks, define the simulation scenarios, and organize the training sessions in an appropriate way. The mocks have to be developed considering the real environment in terms of interfaces and working principles. Moreover, they shall consider multi-user simulation - since performing a process normally involves several actors - and data consistency with the real environment, to provide realistic scenarios that can occur in practice.

Another aspect that has been raised is the need to integrate the simulation mocks with complementary training content, which can be manuals, videos but also the learning content considered for informative learning.
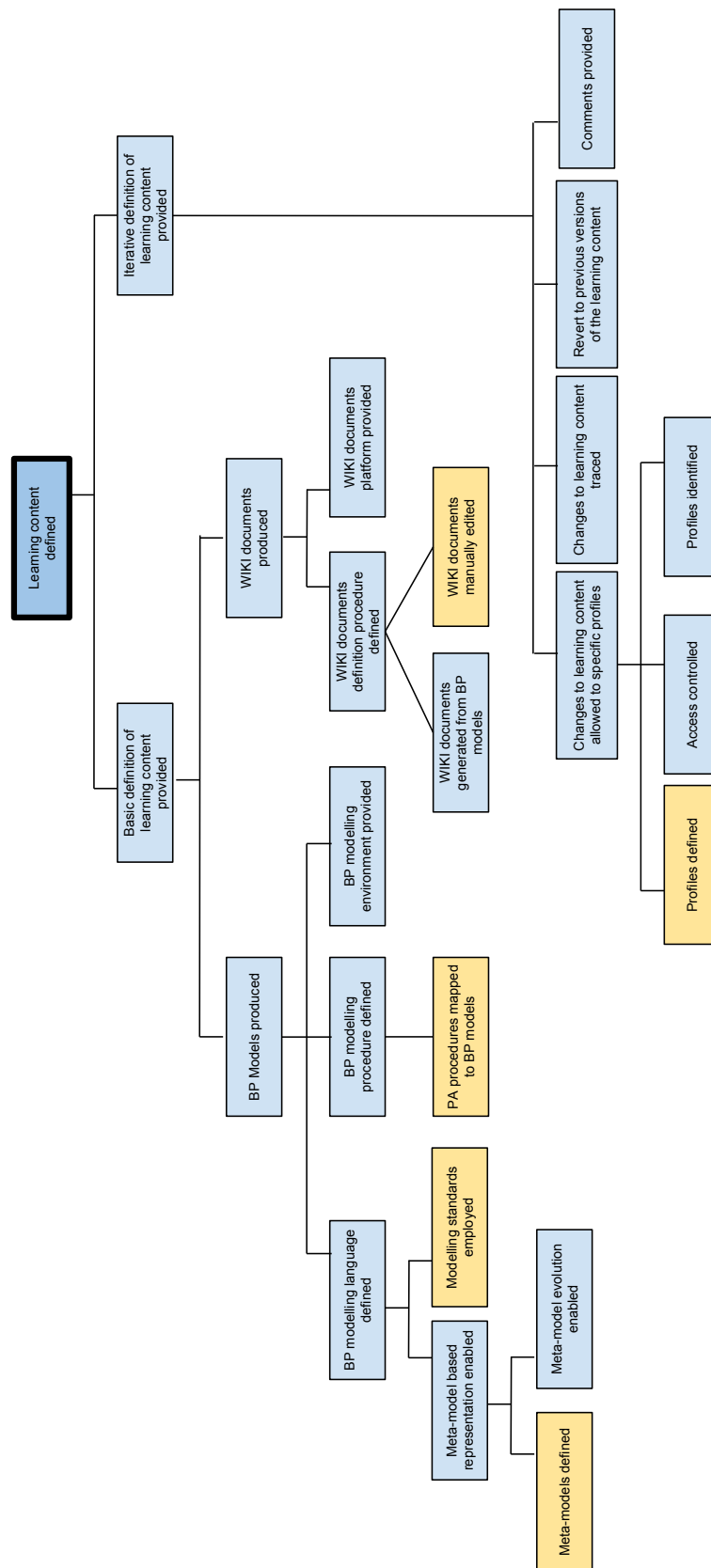
Figure 5.2: Goal Model Associated to the Definition of the Learning Content

Figure 5.3: Goal Model Associated to the Access to the Learning Content

Finally, the execution engine has to be provided for the simulations. Such an engine is expected to execute the simulations, log them, debug and save them. The engine shall also support concurrent access, to enable multi-user simulation.

At this stage, procedure monitoring has not been detailed since the requirements elicited with the KJ method were not addressing this aspect.

5.5. Quality of learning content ensured

Fig. 5.5 outlines the high-level goals associated to the quality assurance of the learning content. Learning content has been identified as the BP models, the WIKI documents and the comments provided by the community. We see that the **quality of simulation scenarios is not detailed** in this goal model, since the quality of such scenarios has not been raised during requirements elicitation. We argue that this aspect has to be considered in further requirements analysis stages.

Quality of **BP models** is going to be provided *before* their definition, by means of a set of guidelines for defining BP models that are readable, well-structured, and that use a reduced set of BPMN constructs to enable clarity. A constrained BP models editor is required to enforce such guidelines. As an alternative to such an editor, a manual check has to be foreseen.

Moreover, quality has to be ensured also *after* BP models definition by means of structural checks that can be performed, e.g., by model checking, and by means of the feedback of the users that can provide comments and judgments to the BP models (**Community-based quality check**). It is worth noting that in this case user profiling has to be considered, to understand if a comment to a BP model is issued by an expert learner of by a novel civil servant.

The same approach, based on guidelines plus additional quality checks is expected for **WIKI documents**. Since such documents are edited in natural language, quality checks will concern ambiguity - lexical, syntactic and pragmatic -, structuring and readability. An issue that has been raised is the **language** to be used for WIKI documents. Indeed, linguistic quality checks are highly dependent on the language. On the other hand, several languages have to be supported. Therefore, it is needed to identify language-dependent quality checks, and language-independent quality checks. At this stage, we expect to implement the language-dependent quality checks only for the English language.

Also the **comments** have to be checked for their quality, which will be performed by tailoring the approaches applied to WIKI documents also to the comments.

Since the BP models and the WIKI documents are tightly related, their **consistency** has to be ensured and consistency rules have to be defined. At deployment stage, consistency between BP models and WIKI documents can be provided by automatically generating the descriptive content of the BP models.

Finally, quality can be ensured also by evaluating the **logs** on the operations performed on BP models and WIKI documents. By evaluating the operations performed on these types of learning content, one can identify typical quality problems that can be avoided in future deployment of novel BP models, and during the update of the WIKI documents.
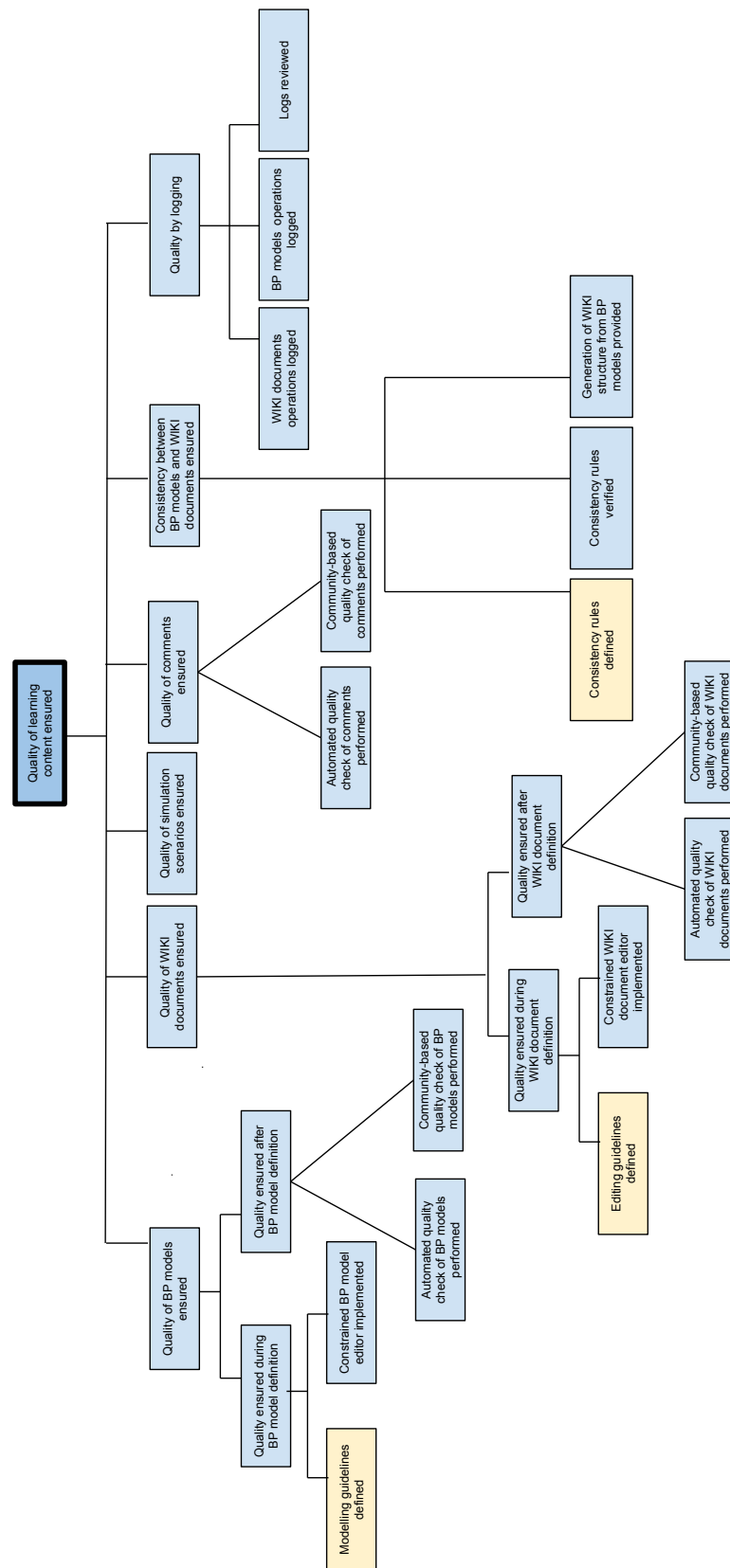
5.6. Knowledge assessment performed

Fig. 5.6 outlines the high-level goals associated to the knowledge assessment of the learners. Knowledge assessment will be performed by means of questionnaires and by performing simulations. Appropriate KPI will be provided to evaluate the results of the knowledge assessment process.

Questionnaires are expected to be manually defined and automatically generated from the BP models. Generation can be based on learner's attributes – i.e., the learner's profile – and based on a reference ontology. The role of ontology is not detailed in the currently elicited requirements and shall be delved more.
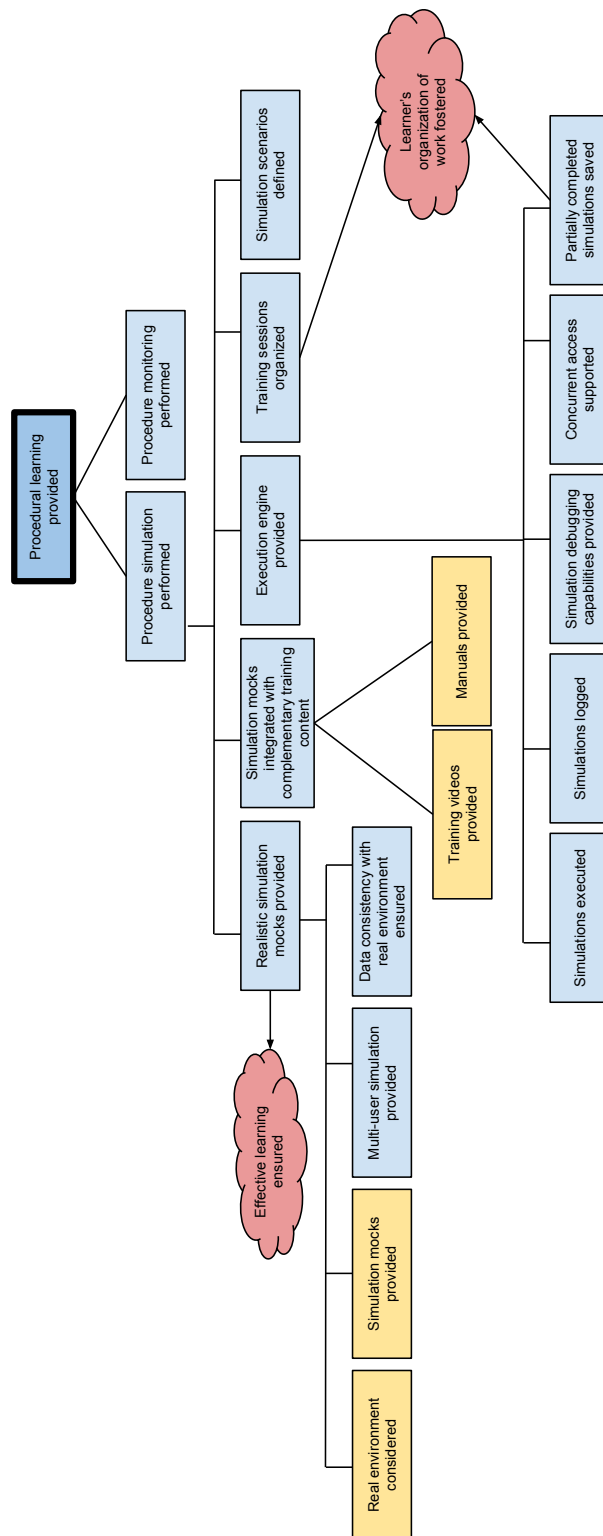
Figure 5.4: Goal Model Associated to the Access to the Means for Procedural Learning

Figure 5.5: Goal Model Associated to the Access to Quality Assessment of the Learning Content

Simulation-based evaluation need to be extended with more detailed requirements. Moreover, we argue that requirements are needed also to give more details on *how* the knowledge assessment process will be performed, and how the training sessions will be performed, since requirements are missing concerning these topics.

5.7. Learning support provided

Fig. 5.7 outlines the high-level goals associated to the learning support capabilities of Learn PAd. Support can be provided directly by BP model experts, that can be designated when the system is deployed or during system evolution, according to the profiling mechanism to be defined based on the contributions to the learning content.

The BP experts will provide suggestions to the BP learners and a mechanism is required to provide such suggestions. From the requirements, two methodologies are foreseen, namely an help-desk that can be contacted by the learners, or a timeline of issues provided to the experts. In the first case, the learners contact the experts, while in the other case it is the other way around.

To foster knwoledge sharing a social network look-and-feel has been suggested.

5.8. Preliminary analysis of requirements completeness

The abstract view provided by means of goal models has enabled the possibility to perform a preliminary, informal evaluation of the parts of the system that have not been properly detailed (i.e., that have few or very generic requirements associated to them). In particular, areas to be detailed more are:

1) **Procedure monitoring:** details have to be given, and requirements have to be defined concerning the activities required to monitor the procedures in their day-by-day application and provide useful feedback to be employed for improvements of the learning content;

2) **Quality of simulation scenarios:** at this stage, scenarios have not been considered under the name of "learning content", and for this reason issues concerning the quality of scenarios have only partially raised. Additional requirements are needed to cover this aspect;

3) **Simulation-based evaluation:** requirements concerning the evaluation of the learners based on the simulations performed have to be provided;

4) **Role of ontologies:** ontologies appeared to be useful to support indexing and search of the learning content. Moreover, they have been also mentioned as a mean to improve the quality of the WIKI documents, enable consistency between BP models and WIKI documents and generate questionnaires. However, more detailed requirements have to be provided to understand the role of ontologies within the Learn PAd project;

5) **Organization of training sessions:** a goal in Fig. 5.4 specifies that training sessions have to be organized. However, requirements have not been elicited for this aspect: when will the training sessions be performed? when will the knowledge assessment be performed? how will a learner be evaluated? requirements are needed to address these issues;

6) **Profiling:** profiling affects both the definition of the learning content, the knowledge assessment, the community-based quality check of the learning content, the learning support, and the means for procedural learning. Profiling can be regarded as a **cross-cut concern** of the Learn PAd project, since it impacts on most of the goals of the platform. Therefore, the role of profiling needs to be detailed with more specific requirements. At this stage, we see that the profile of a user depend on (a) its initial characteristics, on (b) its *contribution* to the learning content, and on (c) the results of the *knowledge assessment*.
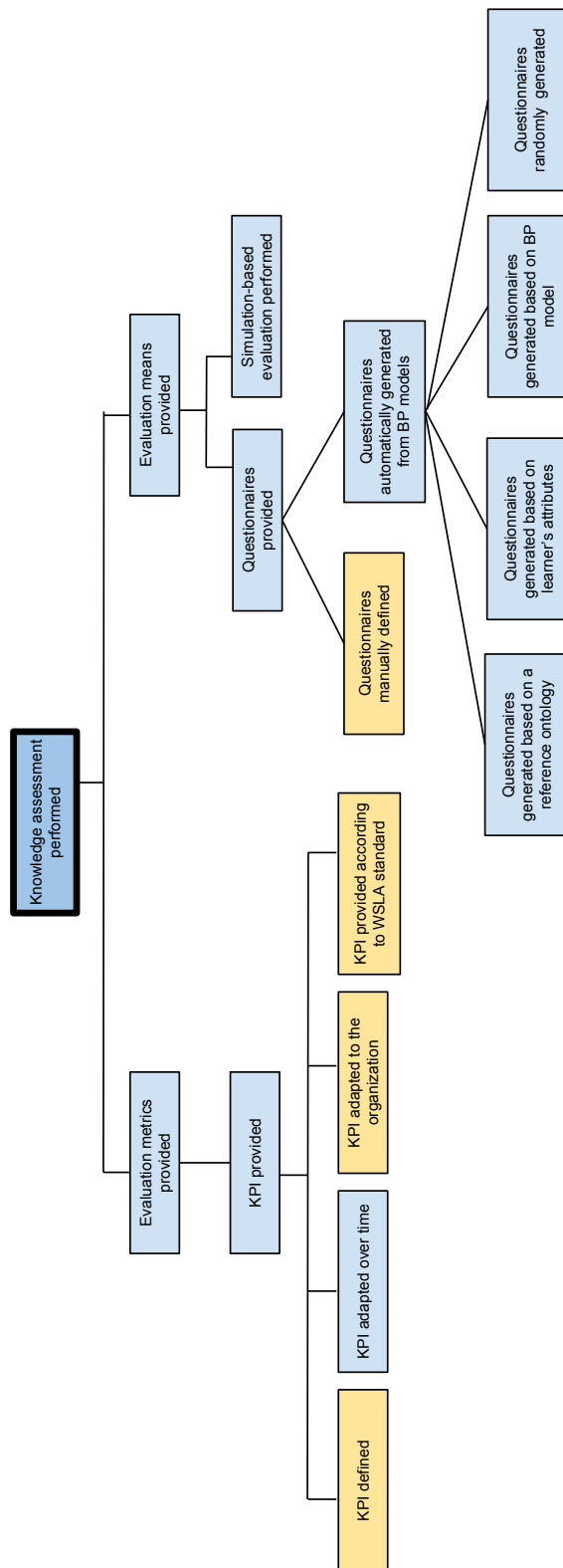
Figure 5.6: Goal Model Associated to the Knowledge Assessment of the Learners
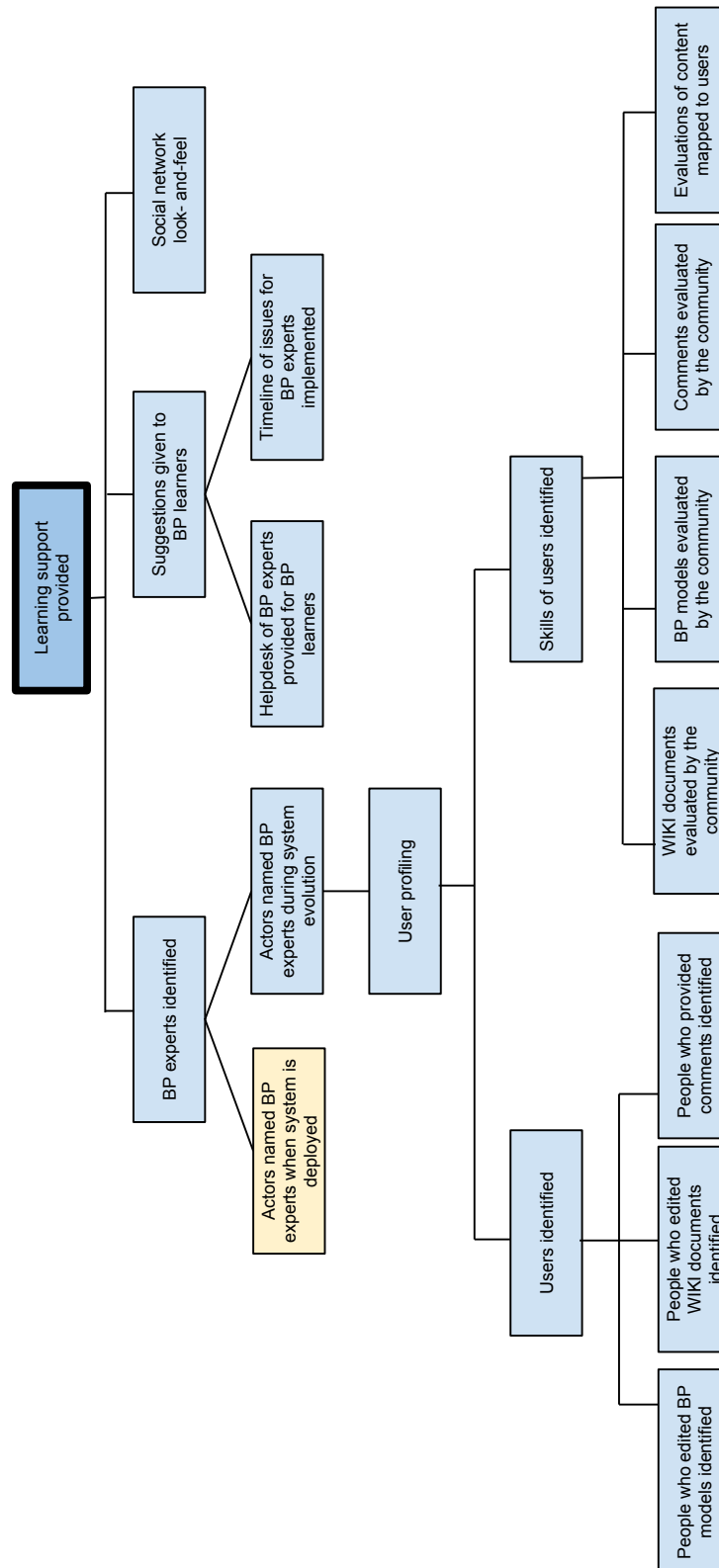
Figure 5.7: Goal Model Associated to the Learning Support Capabilities of Learn PAd

6 Conclusions

This report introduced how requirements had been selected and analysed in Learn PAd, by providing an overview on the selected approach, presenting the material and defining input for the other work-package.

The application of the KJ methods, in conjunction with the open and collaborative usage of adapted Volere templates under the XWiki platform, led the consortium to identify a set of 320 requirements. Such a set included elements different in both quality, and level of detail. This had been considered as a success, as in a minimum of time, there was a detailed discussion on requirements and system behaviour and an impressive list of detailed aspects are available to the consortium.

The use of the XWiki collaborative platform for the requirement collection was extremely useful; however traditional tools for requirement analysis need better integration, which resulted to be a bit cumbersome if it had to be carried on just within the platform. Current approach in the given time framework was the export into Excel Sheet, which provides more easily manageable features to filter and compare requirements but loses the collaborative aspects.

The definition of a core team of key partners was required. The core team directly worked on the analysis step; successively, their results were revised and validated by all partners members. The work of the core team (i.e. cross-reading, and panel sessions) contributed to establish a common and detailed understanding of the Learn PAd system among the partners.

The use of business process design to derive user requirements (as in the PROMOTE® approach) was over-estimated. In the current status the behaviour of the system could be derived also by sample processes, without the necessity to analyse each business process in detail. So the use of introductory sample processes was sufficient to derive major functional capabilities. In order to complete this view, additional use cases had been introduced that describe certain aspects of the learning platform, which are usually independent on the concrete content of the business process.

The use of goal model was found very useful, as this principle of structuring and analysing requirements enabled the top-down point of view by an analytical discussion of collected requirements and comments, as well as enabled the completion of missing requirements.

Conclusion is that the requirement collection and analysis process had been performed efficiently and effectively resulting in almost 200 functional capabilities that provide a mature insight of the expected learning management system.

The activities about requirements have been carried out in parallel with the first discussions about the architecture in WP2. Thus, future work will include both : (a) a bi-directional interaction between WP1 and WP2 in order to exploit a more mature evolution of the architecture, (b) the assessment of the current specification of the requirements and their trace/allocation with respect to the resulting architecture.

In addition, the analysis highlighted a cluster of requirements that need further details. Those requirements are kept accessible to the members of the consortium. While the definition of the architecture becomes more mature and detailed, also these requirements could be allocated in more detail to enable a common workspace.

The current requirement list will be used in all workpackages, as source of reference material, ideas and expected functional behaviour. Specifically, they will be mainly refferred by: WP1 in order to deal

with their evolution; WP2 in order to properly structure the software architecture; and in WP8 in order to enable end users scenario demonstration.

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